SN 278

LING ELECTRONICS, INC.

INSTRUCTION MANUAL

MODEL DCS-7000SR/SA

SINE

VIBRATION CONTROL SYSTEM

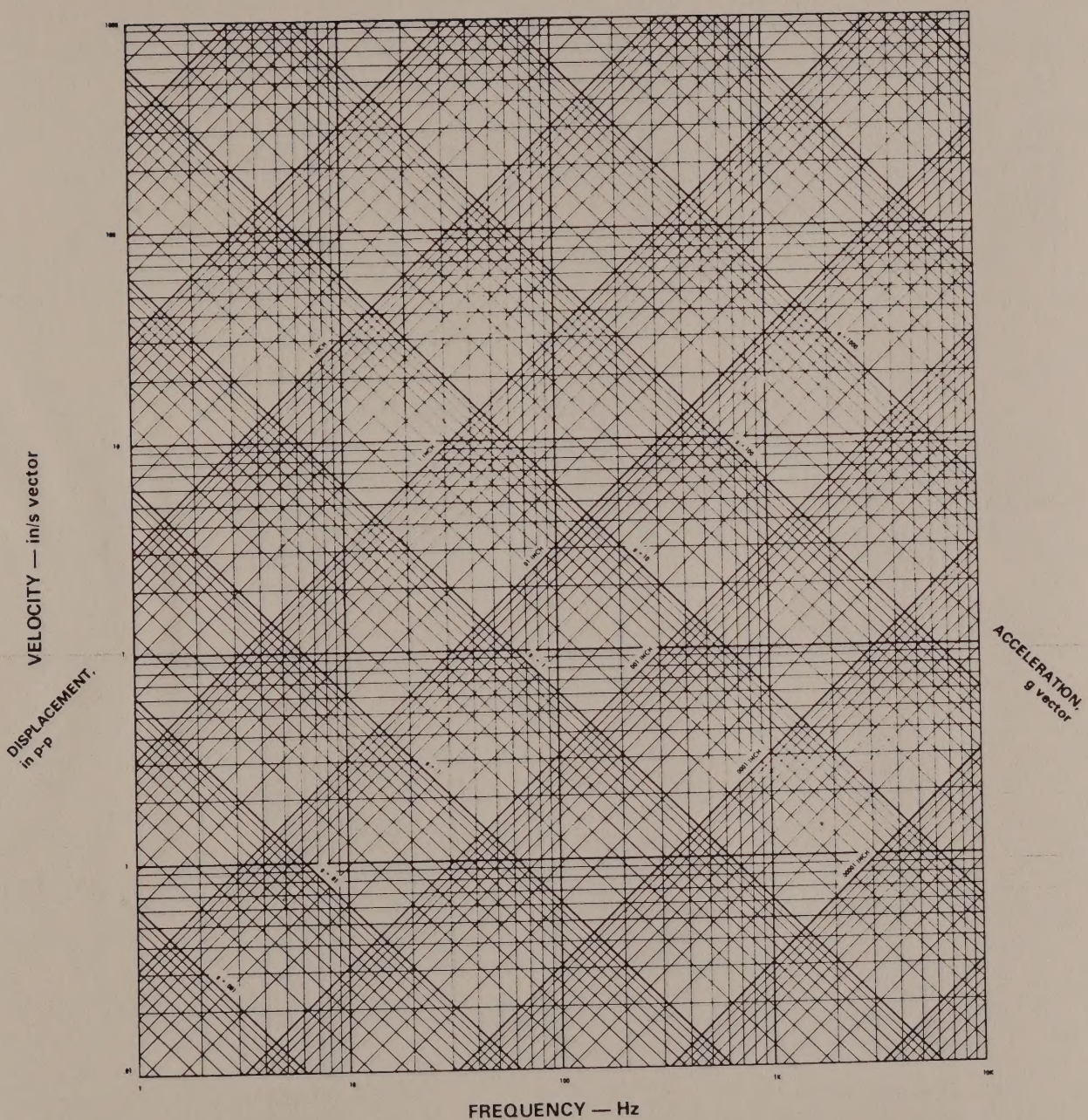
M706726 SERIAL NUMBERS
0987 110 AND UP

If unit is equipped with optional Random Controller refer to Manual M706702 for Random Operation.

Ling Electronics, Inc.
4890 E. La Palma Ave.
Anaheim, CA 92806

(714) 779-1900

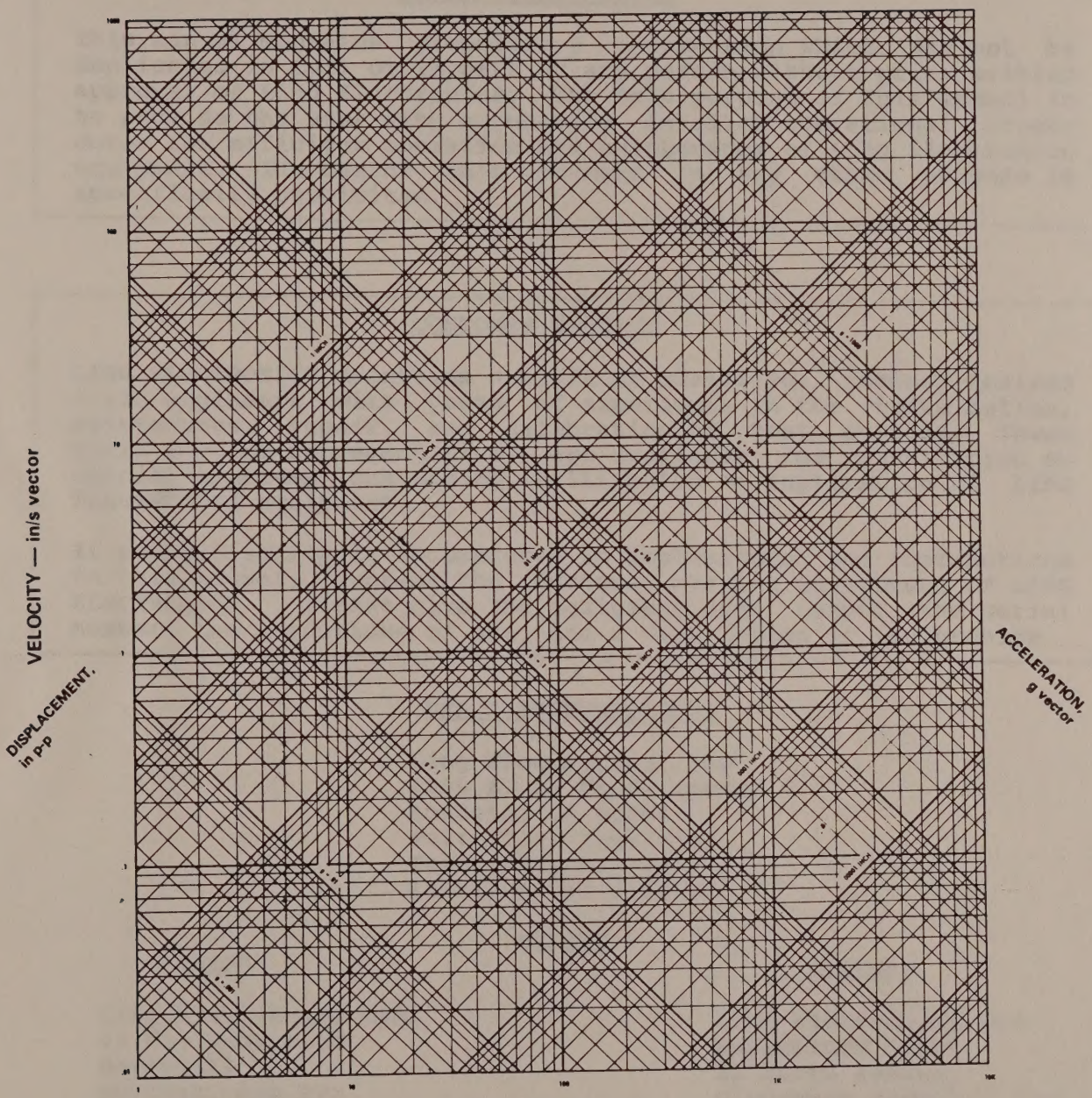
(THIS PAGE INTENTIONALLY BLANK)



Example: Given Frequency = 100 Hz
and Displacement = .02 in p-p
then, Acceleration = 10 g vector
and, Velocity = 6.2 in/s vector

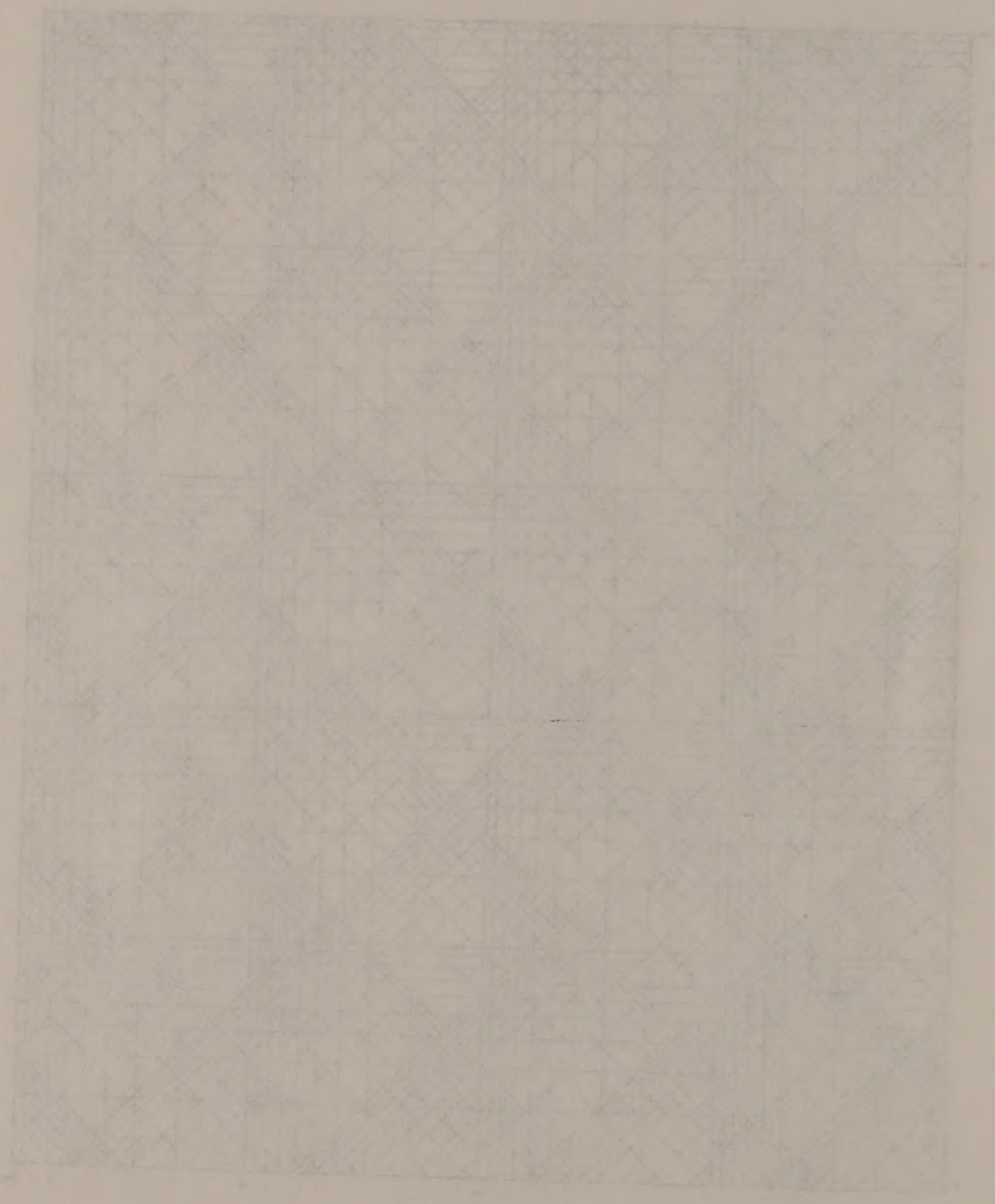
VIBRATION NOMOGRAPH

APPENDIX A



Example: Given Frequency = 100 Hz
and Displacement = .02 in p-p
then, Acceleration = 10 g vector
and, Velocity = 6.2 in/s vector

VIBRATION NOMOGRAPH



PROPRIETARY NOTICE

This manual contains proprietary information which may not be duplicated in full or in part by any person without prior written approval of Ling Electronics. The sole purpose of this manual is to provide the user with adequately detailed operational procedures for efficient operation and maintenance of Ling Electronics equipment. The use of this document for any other purpose is specifically prohibited.

CUSTOMER SERVICE

LING ELECTRONICS maintains a staff of qualified, factory-trained field engineers with years of experience in the installation, maintenance, repair, and calibration of test systems. These field service representatives are available for consultation on special problems concerning utilization or application of LING ELECTRONICS equipment.

If any difficulty is encountered in implementing the instructions in this manual, contact the Customer Service Department of LING ELECTRONICS. Please give the equipment model number, the serial number, the conditions of use, and a description of the problem.

USA & INTERNATIONAL

Ling Electronics, Inc.
4890 E. La Palma Avenue
Anaheim, CA 92806
Tel: (714) 779-1900
Telex: 910-591-1179
Telefax: 714-779-7714

EUROPE

SALES

Ling Electronics Ltd.
49 Hollands Road
Haverhill
Suffolk, CB9 8PJ
United Kingdom

Tel: 44-440-62162
Telex: 817569
Telefax: 44-440-62159

FACTORY

Ling Electronics Ltd.
Rutherford Court
15 North Avenue
Clydebank Business Park
Clydebank, Glasgow
Scotland G81-2QP

Tel: 041-952-0000
Telex: 778677
Telefax: 041-941-2090

(THIS PAGE INTENTIONALLY BLANK)

STATEMENT OF GENERAL CONDITIONS AND WARRANTY

LING ELECTRONICS, INC. (hereinafter referred to as LING) warrants its Vibration Test Systems and Vibration Test Products to be free of defects in material and workmanship for a period of one year after shipment, or in the case of systems and/or products where checkout by an authorized representative of LING is included in the purchase, warranty shall be one year from date of checkout, but in any case, will expire 15 months from date of shipment. Warranty does not cover the LING product unless it is properly installed in accordance with current approved, written instructions and manuals of LING, maintained by Purchaser in accordance with provisions of such instructions and manuals, and unless it is used under normal operating conditions.

WARRANTY is limited to supplying the Purchaser with replacement or repair of any part or parts which, in LING's opinion, are defective. Commercial products purchased by LING, installed and made a part of the Vibration Test System, will carry the original manufacturer's warranty only. In the case of defective parts or products, LING reserves the right to request the return to LING's factory or to inspect them at the Purchaser's installation at LING's discretion, and also reserves the sole right to determine whether defective parts or products will be repaired or replaced. In the event LING determines that the defective parts or products are to be returned to the factory, LING will provide a Customer Return Authorization Number. All shipping costs shall be borne by the purchaser.

WARRANTY does not cover any cost incurred by the Purchaser as the result of the purchase of LING Vibration Test Systems or Products nor does warranty cover cost incurred by the Purchaser, for labor charges for replacement of parts, adjustments or repairs, or any other work performed by the Purchaser or his agents on, or connected with LING supplied equipment.

SERVICES performed by LING due to defects in workmanship or material, other than commercial products purchased by LING, shall be supplied free of charge, on Vibration Test Systems and Products where checkout by authorized representatives of LING is included with the purchase, for a period of 90 days from date of checkout. Maintenance service and service beyond that specified shall be provided at LING's prevailing Service Rate Schedule or by Service Contract Agreement.

WARRANTY is expressly in lieu of any and all other warranties or representations, expressed or implied, and of any obligations or liabilities of LING to the Purchaser arising out of the use of said products, and no agreement or understanding varying or extending the same will be binding upon LING unless in writing, signed by an authorized representative of LING.

WARRANTY shall not apply to any product which, in the judgement of LING has been subjected to misuse or neglect, or has been repaired or altered (after checkout by an authorized representative of LING if checkout is included in the terms of sale) outside the LING factory in any way which may have impaired its safety, operation or efficiency, or to any product which has been subjected to accidental damage. Operation of Vibration Test Systems or products and component parts thereof by the Purchaser, (where checkout by an authorized representative of LING is required), prior to this checkout may void all warranties.

LING reserves the right to make changes in design or additions to, or improvements in, the Vibration Test Systems and Products at any time, without imposing any liability on itself to install the same in any product manufactured or supplied prior therto.

Notwithstanding the provisions of the Warranty stated above, Permanent Magnet Shakers are warranted for a period of 90 days from date of shipment, and all Warranty repairs will be performed at LING's factory.

TABLE OF CONTENTS

Subsection		Page
	SECTION 1	
	DESCRIPTION AND TECHNICAL SPECIFICATIONS	
1.1	GENERAL	1-1
1.2	DESCRIPTION	1-2
1.3	TECHNICAL SPECIFICATIONS	1-3
	SECTION 2	
	RECEIVING INSPECTION	
2.1	UNPACKING AND INSPECTION FOR DAMAGE	2-1
2.2	SYSTEM COMPONENTS	2-1
	SECTION 3	
	FRONT AND REAR PANEL FEATURES	
3.1	FRONT PANEL FEATURES	3-1
3.1.1	Monitor and Diskette Drives	3-1
3.1.2	Switches, Control and Connector	3-2
3.2	REAR PANEL CONNECTORS	3-2
	SECTION 4	
	OPERATION	
4.1	START UP	4-1
4.2	SELECTING AND RUNNING A TEST	4-3
4.2.1	Library Module - Test File Library	4-3
4.2.2	Entering the Test Module from the Library Menu	4-4
4.3	TEST MODULE DISPLAY AND OPERATION	4-5
4.3.1	Control and Monitor Channel Display	4-6
4.3.2	Display Functions	4-7
4.4	SOFT KEY SWITCH DESCRIPTION FOR THE TEST SCREEN	4-7
4.4.1	Switch No. 1 - Output ON/OFF	4-7
4.4.2	Switch No. 2 - Sweep HOLD/ON	4-7
4.4.3	Switch No. 3 - REVERSE	4-8
4.4.4	Switch No. 4 - SETUP	4-8
4.4.5	Switch No. 5 - PRINT	4-8
4.4.6	Switch Nos. 6, 7, 8	4-9
4.4.7	Switch No. 9 - LIBRARY	4-9
4.4.8	Switch No. 10 - EXIT	4-9
4.5	SOFT KEY SWITCH DESCRIPTIONS FOR THE REVIEW OF THE SETUP SCREEN	4-9
4.5.1	Switch No. 4 - TEST	4-10
4.5.2	Switch No. 5 - PRINT	4-10
4.6	MAIN MENU	4-10
4.6.1	Option A - Run Sine Test Profiles	4-10
4.6.2	Option B - Edit Sine Test Profiles	4-10

Subsection | Page

SECTION 4 (continued)
OPERATION

4.6.3 Option C - Manual Control 4-11
4.6.4 Option D - Help 4-11
4.6.5 Option Z - Exit to the System 4-11
4.7 MANUAL CONTROL MODE 4-12
4.7.1 Manual Frequency and Level Control Use 4-13
4.7.2 Calibration of the Analog Plotter 4-13

SECTION 5
EDIT MODULE

5.1 PURPOSE 5-1
5.2 ENTERING AND EXITING THE EDIT MODULE 5-1
5.2.1 Creating or Replacing a Database File 5-2
5.2.2 Other Library Menu Functions 5-2
5.3 EDITING FUNCTIONS AVAILABLE IN THE EDIT MODULE . . 5-2
5.3.1 Cursor Movement Keys 5-3
5.3.2 ENTER/RETURN Key 5-4
5.3.3 Backspace (<--) and Delete (DEL) Keys 5-4
5.3.4 Page Down Key (Pg Dn) 5-4
5.3.5 Escape Key (ESC) 5-5
5.4 BREAKPOINT EDITING 5-5
5.4.1 Manual Breakpoint Editing 5-5
5.4.2 Autobreakpoint Editing 5-8
5.4.3 On-line Help Screen 5-10
5.4.4 Printing a Copy of the Edit Screen 5-10
5.4.5 Exiting to the Main Menu 5-11
5.4.6 Reselecting the Edit Library 5-11
5.4.7 Saving a Sine Database File 5-11
5.5 CREATING AND SAVING A NEW TEST DATABASE 5-11
5.5.1 Preliminary Considerations 5-11
5.5.2 General Approach 5-12
5.5.3 Procedure 5-12
5.6 MODIFYING AND RE-SAVING AN EXISTING DATABASE . . . 5-17
5.7 MAKING BACK-UP COPIES OF PROGRAM AND DATABASE DISKETTES 5-18
5.8 SETTING THE SYSTEM DATE AND TIME 5-19

SECTION 6
TROUBLESHOOTING AND MAINTENANCE

6.1 START-UP PROBLEMS 6-1
6.2 VIBRATION SYSTEM PROBLEMS 6-1
6.3 DCS-7000SR OPERATING PROBLEMS 6-1
6.4 OTHER TROUBLES 6-1
6.5 MAINTENANCE 6-3

TABLE OF CONTENTS

Subsection — Page

SECTION 7
GLOSSARY OF TERMS

7.1 PURPOSE 7-1
7.2 GENERAL SYSTEM AND RANDOM VIBRATION TERMINOLOGY . . 7-1

APPENDIX A

VIBRATION NOMOGRAPH A-1

APPENDIX B

USEFUL CONVERSION FACTORS B-1
CALCULATIONS FOR PURE SINUSOIDS B-2
FORMULAS FOR SINUSOIDAL MOTION B-3
EXAMPLE CALCULATIONS B-4

LIST OF FIGURES

Figure

1-1 DCS-7000SR Vibration Control System 1-1
3-1 Front Panel Features 3-1
3-2 Rear Panel Features 3-4
4-1 Typical Software Identification Display 4-1
4-2 Aborted Test (Default Run Screen) 4-2
4-3 Main Menu 4-3
4-4 Test File Library Menu 4-4
4-5 Review of the Test File Parameters 4-5
4-6 Test Screen 4-6
4-7 Sine Sweep Test in Progress 4-8
4-8 Typical Review of the Edit Screen 4-9
4-9 Main Menu Display 4-10
4-10 Main Menu Help Screen 4-11
4-11 Initial Manual Control Screen 4-12
5-1 Typical Edit Library File Menu Display 5-2
5-2 Typical Edit File Display with Parameters 5-3
5-3 Examples of Choice for Breakpoint Entry 5-6
5-4 Single Character Entry Example 5-9
5-5 Edit Help Screen 5-10

LIST OF TABLES

Table

6-1 DCS-7000SR System Error Messages 6-2

(THIS PAGE INTENTIONALLY BLANK)

SECTION 1

DESCRIPTION AND TECHNICAL SPECIFICATIONS

1.1 GENERAL

The Ling DCS-7000SR Vibration Control System (Figure 1-1) provides sinusoidal drive signal generation and automatic control of sinusoidal vibration tests on electrodynamic and electrohydraulic shaker systems. The DCS-7000SR is a high speed, closed loop, digital controller, incorporating a microcomputer with a math co-processor operating as a host processor to a separate sine controller board that uses a TMS-32010 DSP processor. The following hardware along with the processors are all incorporated as part of the overall system that includes, an integral CRT monitor, dual floppy diskette drives for storage of its program and an unlimited number of programmable test databases. It provides monitoring and control of the essential performance and test item protection parameters necessary for successfully conducting sinusoidal vibration, environmental and production screening tests.

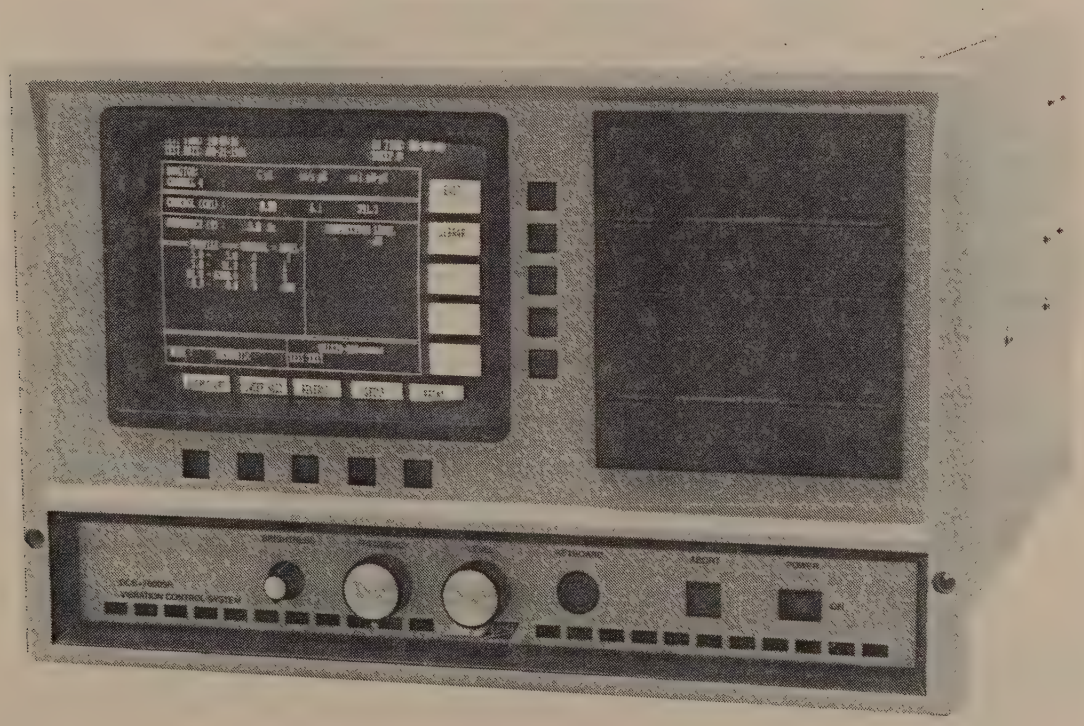


Figure 1-1. DCS-7000SR Vibration Control System

1.2 DESCRIPTION

The DCS-7000SR Vibration Control System comprises the following major components:

1. Monitor - 9-in CRT display unit, provides high resolution graphic and alpha-numeric displays.

2. Dual Diskette Drives - provide for program and test database storage on 5-1/4 in, double sided, double density diskettes.

3. Alpha-Numeric Keyboard - permits entering of test parameters and usage of the System as a general purpose microcomputer.

4. Microcomputer host - comprises a 16-bit microprocessor, a numeric co-processor, and 512K bytes of random access memory (RAM), expandable to 576K bytes, capable of operating independently as a general purpose microcomputer.

5. Sine controller Board - converts input acceleration signals to digital form with a high speed 12 bit A/D converter and the output digital drive signal is converted to analog form using 16-bit precision. It contains programmable gain amplifiers, and anti-aliasing filters. A Texas Instruments, TMS-32010 Digital Signal Processor is used to perform the necessary FFT, digital filtering and processing on the raw input data and then modifies the output sinusoidal waveform in response for closed loop control. The results are passed back to the host for display.

6. Color Graphics Adapter (CGA) - provides bit-mapped memory and control for graphic and alpha-numeric displays on CRT display.

7. Diskette Drive Adapter - provides interface and control of up to four diskette drives (two standard).

8. Parallel Input/Output Adapter - provides interface for optional dot matrix printer, contains battery back-up real time clock/calendar.

9. Dot Matrix Printer (Optional) - provides high resolution copies of monitor displays.

10. Video matrix printer (Optional) - provides quick high resolution copies of the monitor displays without burdening the host for processor time.

1.3 TECHNICAL SPECIFICATIONS

PARAMETER	SPECIFICATIONS
• MONITOR	9-in CRT, provides communication to operator by display of menus, database information from stored profiles, soft key switch labels, control profile and monitor level information, sweep progress, etc.
• FREQUENCY CHARACTERISTICS	
Range	5 to 6500 Hz (in 0.1 Hz steps)
Profile Definition	2 to 9 frequency breakpoints or up to 8 levels of control
• DYNAMIC RANGE	Greater than 80 dB
• INPUT CHARACTERISTICS	
Number of Channels	Two total:
Control (channel 1)	1 (Single Channel System) Normalized for 10 mV/g
Monitor (channel 4)	1 (for monitoring test levels). Normalized for 10 mV/g
Maximum Voltage	20 V p-p
Sensitivity	10 mV/g, each channel
Impedance	100K ohms
• OUTPUT CHARACTERISTICS	
Maximum Voltage	20 V p-p, 7 Vrms
Waveform	Sinusoidal, digitally generated with 16 bit precision.
Stability	50 ppm/°C
Distortion	Less than 0.1% at 5 V rms

1.3 TECHNICAL SPECIFICATIONS (cont.)

PARAMETER	SPECIFICATIONS
• OUTPUT CHARACTERISTICS (cont.)	
Protection	Short circuit protected
Source Impedance	100 ohms
• SWEEP TYPES	Log or Linear May program total number of single direction sweeps to 999 maximum
Logarithmic	0.01 - 9.99 Oct/min (max)
Linear	0.1 - 99.9 Hz/sec (max)
Manual Sweep	Is accomplished by control and use of a front panel optical encoder that is rate sensitive
• COMPRESSION SERVO	20 to 0.5 dB; 60 to 2 dB (>80 dB Compression Limit)
• COMPRESSION SPEED	
Range	Programmable, 10 to 999 dB/s, in 1 dB/sec steps
Rate	Slow: 0.5 dB/sec/Hz Med: 1.0 dB/sec/Hz Fast: 3.0 dB/sec/Hz
• MEASUREMENT DISPLAY	
Frequency	4 digit display (with 0.1 Hz resolution to 999.9 Hz and 1 Hz resolution above 1 kHz)
• CONTROL DISPLAY	
Acceleration	0.2 g to 200.0 g peak
Velocity	0.1 to 199 in/s peak
Displacement	0.002 to 2 inches pk-pk

PARAMETER	SPECIFICATIONS
• MONITOR DISPLAY	
Accuracy	5% ± 2 digits
Acceleration	0.1 g to 49.9 g peak
Velocity	0.1 to 199 in/s peak
Displacement	0.002 to 2 inches pk-pk
• CONTROL ACCURACY	Dependent on the sweep and compression rates selected but typically better than ± 0.4 dB
Acceleration	0.2 to 200 g (5.0 to 6500 Hz)
Velocity	0.1 to 199 in/s (5.0 to 1 kHz)
Displacement	2 in pk-pk max. Minimum level is limited to 0.2 g from 5.0 Hz to 1 kHz and system noise floor level. 100 mV/g accelerometer should be used for low level testing.
• CONTROL CHARACTERISTICS	
Accuracy	± 0.4 dB
• TEST DEFINITION	
Test Database	Complete, programmable definition of test parameters, including: • the number of sweeps • frequency range • compression rates and limits • breakpoint definition • X-Y plotter enable/disable • system parameters
Number of Databases	Up to 11 programmable test databases stored on one 5-1/4 in floppy diskette.

1.3 TECHNICAL SPECIFICATIONS (cont.)

PARAMETER	SPECIFICATIONS
• TEST DEFINITION (cont.)	
Number of databases (cont.)	An unlimited number of diskettes may be used to store test files.
Keyboard	Computer type keyboard for creating/editing test databases, removable to prevent unauthorized changes to test parameters.
• TEST CONTROL	
Local	10 soft key touch switches under program control plus permanent abort switch, provide manual or automatic start and stop of test.
Remote	Rear panel barrier strip terminals (TB4) for test start and stop. Local or remote Start/Abort input by momentary contact closure. Also, a N.O. contact is used to indicate vibration ON/OFF status (VIB. MON.) at TB4.
Outputs:	Fixed sine and squarewave outputs from rear panel BNC connectors. Both the fixed sine and squarewave outputs are 5V pk-pk maximum into a 1MΩ input impedance. DC proportional to log of frequency and "g" level outputs to 100 g (max), with TTL pen lift from a rear panel "D" type connector. X-Y plotter outputs are 5 Vdc maximum into 1MΩ input impedance.

PARAMETER	SPECIFICATIONS
• TEST ITEM PROTECTION	
Overall Level	Abort limits, fixed at ±3dB above and below overall g peak reference profile level.
Open Loop Detection	Test aborted in less than 10 s
• AMBIENT OPERATING TEMPERATURE	60° F to 90° F (15.5° C to 32° C)
• AMBIENT STORAGE TEMPERATURE	50° F to 110° F (10° C to 43° C)
• POWER	
Standard	115 V ac, ±10 %, 3.0 A, 60 Hz
Optional	230 V ac, ±10 %, 1.5 A, 50 Hz
• DIMENSIONS	
Height	12 in (305 mm)
Width	19 in (483 mm)
Depth	25.5 in (648 mm)
• WEIGHT	70 lb (32 kg), approx.
• OPTIONS	
Configuration	Rackmount or tabletop versions
Printer	Ling Model DMP-100 (Dot Matrix Printer) or VMP-100 (Video Matrix Printer) for hard copies of test parameters and screen displays
Random Controller	Field-retrofittable Printed Circuit Board Assembly and Software provides random signal generation and control

(THIS PAGE INTENTIONALLY BLANK)

SECTION 2

RECEIVING INSPECTION

2.1 UNPACKING AND INSPECTION FOR DAMAGE

The Model DCS-7000SR Vibration Control System is packaged for protection against possible damage during shipment. Upon its receipt, the System should be unpacked immediately and inspected for loose, broken, or damaged components.

Should any be discovered, the Agent of the delivering carrier should be so notified. An acknowledgement form, signed by the Agent, should then be obtained before formally accepting the shipment.

2.2 SYSTEM COMPONENTS

Listed below are the individual items shipped as part of the DCS-7000SR System, including non-installed options if ordered. After checking the Packing List for any backordered items, immediately report any missing items to Ling Electronics.

ITEM	QUANTITY	DESCRIPTION
1	1	DCS-7000SR System Unit
2	2	Chassis slides (rackmount version only)
3	1	Computer Keyboard with cable
4	1	Power cord for DCS-7000SR
5	1	LINGFAX D713510 Program diskette, Version X.XXS for Single Channel Systems.
6	1	LINGFAX D713511 Database diskette, Version X.XXS (as above).
7	1	IBM-DOS or MS-DOS Manual with 2 Program diskettes
8	1	Computer Checkup, a Power Up! Program diskette, with "Read Me First" instruction card
9	1	DCS-7000SR Instruction Manual for Sine Controller
		(Options)
1	1	DMP-100 Dot Matrix Printer with power cord, cable, and Instruction Manual
1	1	VMP-100 Video Matrix Printer with power cord, cable and instruction manual.

Note: IBM is a registered trademark of International Business Machines Corporation.
MS-DOS is a registered trademark of Microsoft Corporation.
Power Up! is a registered trademark of Channelmark Corporation.

(THIS PAGE INTENTIONALLY BLANK)

SECTION 3

FRONT AND REAR PANEL FEATURES

3.1 FRONT PANEL FEATURES

3.1.1 Monitor and Diskette Drives

Figure 3-1 shows the positions of the monitor and two diskette drives. The monitor provides graphic and alpha-numeric displays for communication between the System and operator. In the normal operating mode, the LINGFAX Program diskette is installed in Drive A, and the Database diskette is installed in Drive B.

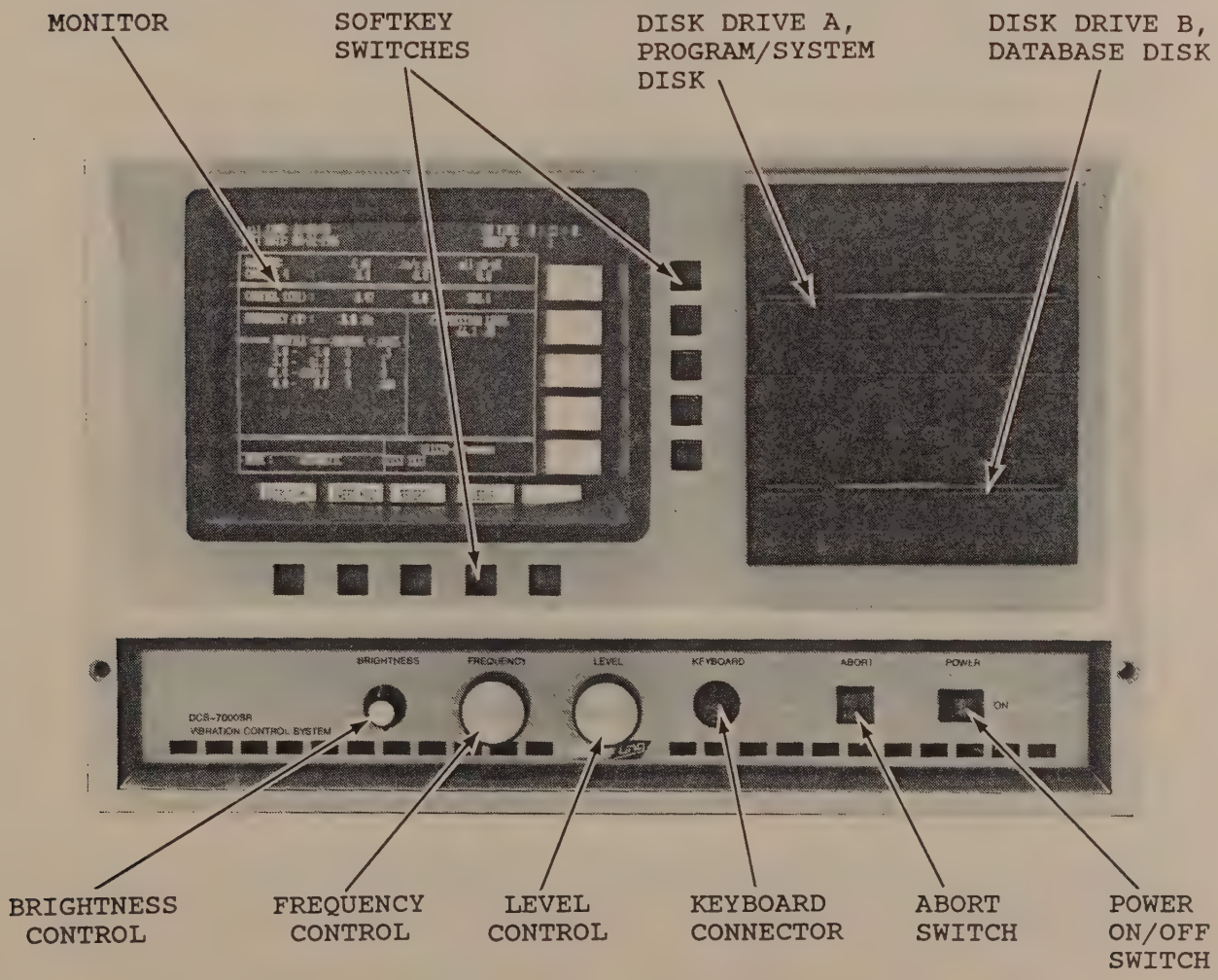


Figure 3-1. Front Panel Features

3.1.2 Switches, Control and Connector

Figure 3-1 also shows the positions of the front panel soft-key switches, BRIGHTNESS control, KEYBOARD connector, ABORT switch, and POWER ON/OFF switch. Their general functions are as follows:

1. Softkey Switches - The label for each of these momentary contact "soft switches" is displayed on the monitor, adjacent to the switch. The function of each switch is under program control and may change, depending on which module or part of the program is currently active. The functions are described in Section 4.

2. BRIGHTNESS Control - This control allows variation in the brightness of the display on the monitor, for optimum viewing in various ambient lighting conditions.

3. FREQUENCY Control - This control enables manual adjustment of the frequency while in manual servo mode.

4. LEVEL Control - This control enables manual adjustment of the compression level while in manual mode.

5. KEYBOARD Connector - This 5-pin DIN connector is provided on the front panel for easy attachment/removal of the computer keyboard. Removal of the keyboard prevents creating, changing, or deleting a test definition stored on the Database diskette.

6. ABORT Switch - This switch allows the operator to manually initiate an immediate soft shutdown when a test is in progress. When a test is aborted, the test time will freeze, and the monitor will display a new set of soft switch options.

7. POWER ON/OFF Switch - This switch controls application of the main power to the System. When the switch is placed in the ON position, it is illuminated, and a series of initializing and diagnostic functions are started.

3.2 REAR PANEL CONNECTORS

Figure 3-2 shows the positions of various connectors on the rear panel. The identification and general purpose of each of these items is as follows:

1. Input Power Connector - This 3-prong male connector receives the grounded ac power cable supplied with

the System. Standard power is 115 V ac, 3A, 50/60 Hz; optional power is 230 V ac, 1.5 A, 50/60 Hz.

2. TB4 Barrier Type Terminal Board - The terminals on this board provide connection points for the following functions:

   (1) START - Remote start input. Requires a momentary contact closure between TB4-1 and TB4-3. This automatically starts the sine profile and begins the sweep.

   (2) STOP - Remote stop/abort input. Requires a momentary contact closure between TB4-2 and TB4-3. This aborts a sine sweep test.

   (3) COM - Common for remote start/stop inputs on TB4-1 and TB4-2.

   (4) VIB MON - Provides access to internal, isolated contact closure between TB4-4 and TB4-5, when vibration is ON.

   (5) VIB RET - See (4).

   (6) AUX 1 - (Not used)

   (7) (Not used)

   (8) AUX 2 - (Not used)

   (9) (Not used)

   (10) (Not used)

3. INPUTS, CH. 1 to 4 - These BNC connectors accept from one to four acceleration signals from the vibration system for analysis and control.

4. External Floppy Disk Drive Connector - This multipin connector provides access at the rear panel to control one or two additional, external diskette drives.

5. Printer Connector - This multipin parallel connector is the interface point for attachment of the optional Dot Matrix Printer.

6. RGB Monitor Connector - This multipin connector is the interface point for attaching a standard, external RGB type monitor.

7. J16 - (No connector)

8. J15 - 9-pin RS-232 serial connector. (Not used)

9. Composite Video Monitor Connector - This RCA type connector is the interface point for attaching an external composite video type monitor.

10. OUTPUT Connector - This BNC connector provides the output random drive signal for input to the vibration system power amplifier.

11. Analog X-Y output connector with pen lift functions.

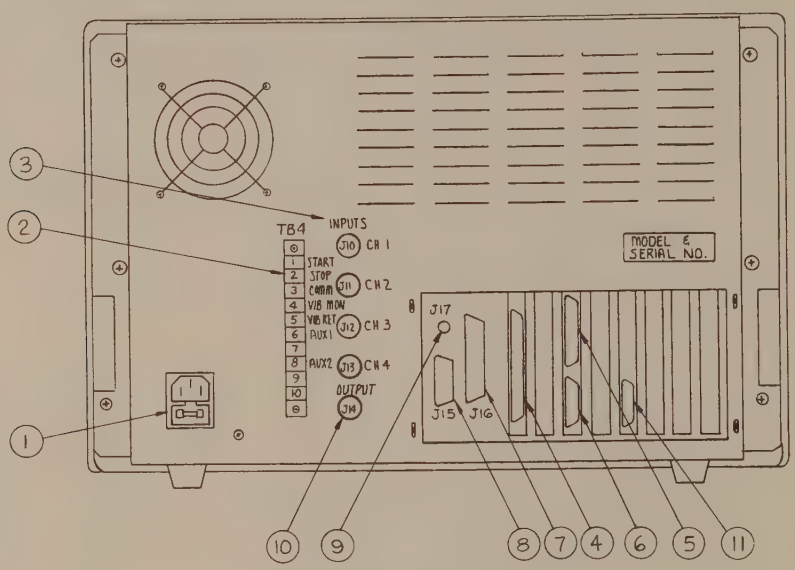


Figure 3-2. Rear Panel Features

The rear panel analog plotter (J19) connector output connections are:

Pin	Description
1 to 5	Common
6	DC proportional to the Log of the frequency out (+ 5 V dc max.)
7	DC proportional to the Log of the acceleration out (+ 5 V dc max.)
8	Pen Lift, TTL compatible normally + 5 V
9	Pen Lift, TTL compatible normally ≈ 0 V

SECTION 4

OPERATION

4.1 START UP

It is not necessary to connect the keyboard if tests are to be run using existing database files previously set up on the 'B' or database diskette. If the EDIT or HELP function modules are to be accessed, it is necessary to have the keyboard connected. Before connecting the keyboard turn the Power ON/OFF switch to OFF.

CAUTION

Do NOT connect or disconnect the keyboard while power is applied to the System. Damage to the keyboard or System Unit may occur.

The keyboard may remain connected while the System is operating in any mode. All keyboard input is ignored when operating in the Test Mode.

Insert the LINGFAX System Diskettes A and B into their respective drives, and then press the ON/OFF switch to ON. The switch will illuminate to indicate that ac power has been applied. A "beep" will be heard, and after a short pause, a cursor will flash in the upper left corner of the monitor. The System is now in a short computer diagnostic test. Should a fault be detected, a series of beeps will be heard, and the monitor will display a message. In such case, note the message, and contact the Ling Electronics Customer Service Department (see Page v) to determine possible corrective actions.

At the end of the power-on diagnostic test (indicating no fault detected), the MTI/LING logo will be displayed. Below the logo, the LINGFAX software title, version, and release date are listed, as illustrated in Figure 4-1.

MTI Ling
SUBSIDIARY OF MECHANICAL TECHNOLOGY INCORPORATED
DCS-7000SR SINE CONTROLLER PROGRAM
LINGFAX SINGLE CHANNEL VERSION 1.1 7/12/87

Figure 4-1. Typical Software Identification Display

After a brief pause the logo is replaced by a review of the Default database (Library #0), then, the screen advances automatically to the RUN screen for immediate use of the default database, as in Figure 4-2. If for some reason the default database does not exist then the main menu, see Figure 4-3, will be displayed. If the default database is present it may now be run by pressing the "OUTPUT" soft switch to display "OUTPUT ON". A "soft start" message will be displayed momentarily. When the proper control level is reached the control level display will be highlighted using bright characters. To start the sweep press the "SWEEP" soft switch so that "SWEEP ON" is displayed. If the "OUTPUT" soft switch is pressed again, or the red ABORT switch is pressed, the last control levels and soft switches will be displayed similar to the screen depicted in Figure 4-2. The default sine profile, if not aborted, will sweep for the specified number of sweeps defined in the user database and stop automatically with a controlled soft shut down and display "SWEEP FINISHED".

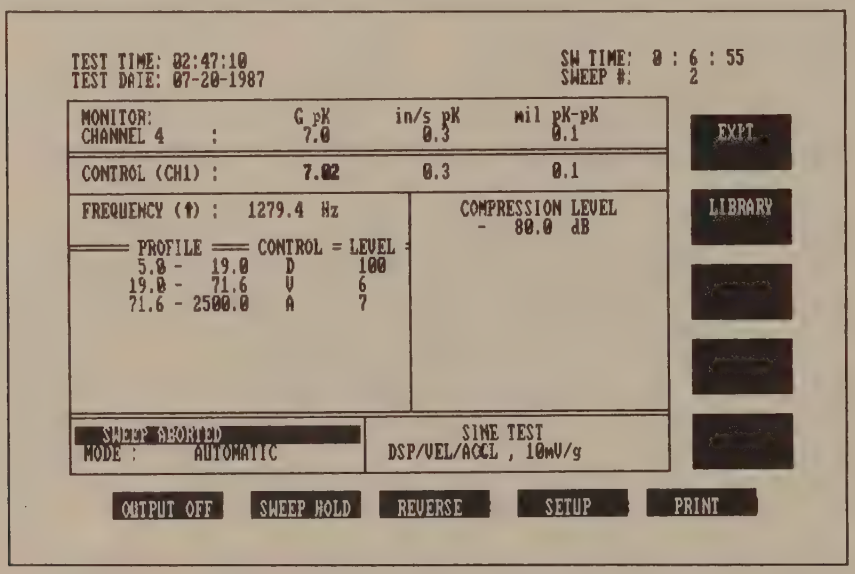


Figure 4-2. Aborted Test (Default Run Screen)

If a test profile other than the default profile is desired then pressing the "LIBRARY" will display the selection of all eleven database files as shown in Figure 4-2.

If it is necessary to create or edit a database file then pressing "EXIT" will cause the main menu screen, as in Figure 4-3, to be displayed. The options from the main menu are selected by pressing the appropriate soft switch or by pressing the corresponding lettered key on the keyboard. A quick on line help reference to the menu selections is available by selecting item (d) from the main menu.

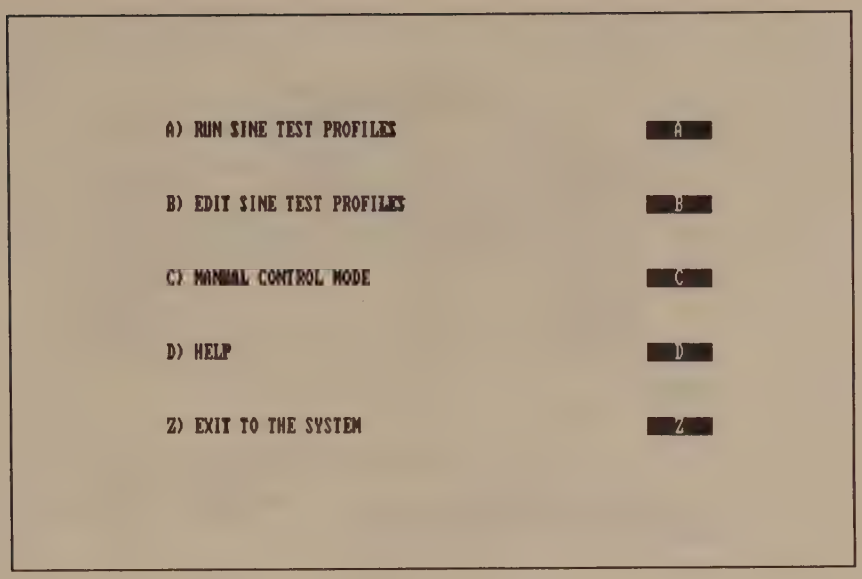


Figure 4-3. Main Menu

4.2 SELECTING AND RUNNING A TEST

The remaining references to the soft key selections will be identified along with a number for clarity. The ten soft keys will be numbered left to right from 1 to 10, beginning with the bottom row of soft keys located below the CRT display. The leftmost bottom soft key is therefore soft key #1 and soft key #10 would be the uppermost soft key to the right of the CRT display, see Figures 4-2 and 4-6.

Upon initial startup of the DCS-7000SR the default database is automatically selected and made ready to run. This sine test file may be started by simply pressing the "OUTPUT", soft switch #1, or by activating the remote start by a momentary short to ground from TB4-1 to 3. If a test profile other than the default database is required then press the "LIBRARY", soft switch #9, (see Figure 4-2) to display the eleven database files as in Figure 4-4. If the main menu is displayed and the required sine test profile already exists, pressing soft key #10 for item A, "RUN SINE TEST PROFILES" will display the eleven database files, Figure 4-4.

4.2.1 Library Module - Test File Library

Figure 4-4 is displayed only in the test mode for the selection of one of the eleven database files. The appropriate sine Test profile is selected by moving the blinking cursor to the respective file using either the keyboard or front panel UP/DOWN cursor arrow keys (soft keys 1 and 2). A sine profile is

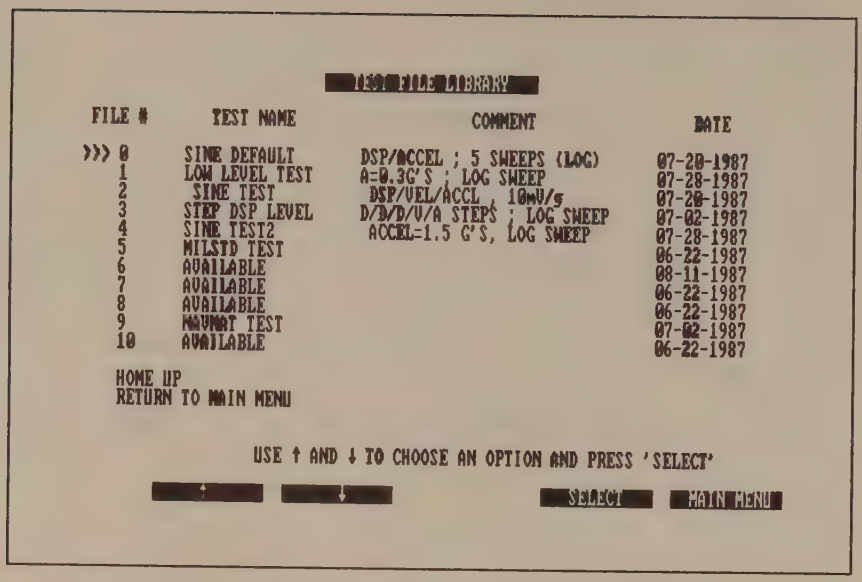

TEST FILE LIBRARY
FILE #
TEST NAME
COMMENT
DATE
>>> 0 SINE DEFAULT DSP/ACCEL ; 5 SWEEPS (LOG) 07-20-1987
1 LOW LEVEL TEST A=0.3G'S ; LOG SWEEP 07-28-1987
2 SINE TEST DSP/VEL/ACCL , 10mV/g 07-28-1987
3 STEP DSP LEVEL D/D/D/V/A STEPS ; LOG SWEEP 07-02-1987
4 SINE TEST2 ACCEL=1.5 G'S, LOG SWEEP 07-28-1987
5 MILSTD TEST 06-22-1987
6 AVAILABLE 08-11-1987
7 AVAILABLE 06-22-1987
8 AVAILABLE 06-22-1987
9 MAVMAT TEST 07-02-1987
10 AVAILABLE 06-22-1987
HOME UP
RETURN TO MAIN MENU
USE ↑ AND ↓ TO CHOOSE AN OPTION AND PRESS 'SELECT'
↑
↓
SELECT
MAIN MENU

Figure 4-4. Test File Library Menu

selected by using either the keyboard ENTER/RETURN key or the front panel "SELECT" soft key #4.

The remaining selections "HOME UP" and "RETURN TO MAIN MENU" are as described. The "HOME UP" selection is simply a quick method to home the cursor back to Library File #0 without having to step back up. The "RETURN TO MAIN MENU" selection is for redisplaying the main menu of Figure 4-3, to choose another option or to review a different database disk by replacing the previous disk and reselecting "RUN SINE TEST PROFILES", soft switch #10.

The "MAIN MENU", soft switch #5, at the library module serves the same function as the "RETURN TO MAIN MENU" selection above. It provides a simple means to exit back to the main menu.

If for some reason a file does not exist on the database disk being read, the message "<FILE NOT FOUND>" is displayed in the title column. This message is repeated for every missing database file.

4.2.2 Entering The Test Module From The Library Menu

Once a sine profile has been selected from the library menu or initially upon power up, the screen display will be similar to that of Figure 4-5. Soft keys #3, "GOTO TEST", #4, "LIBRARY" and #5, "PRINT", indicate the current choices.

This selection allows the review of the contents of the

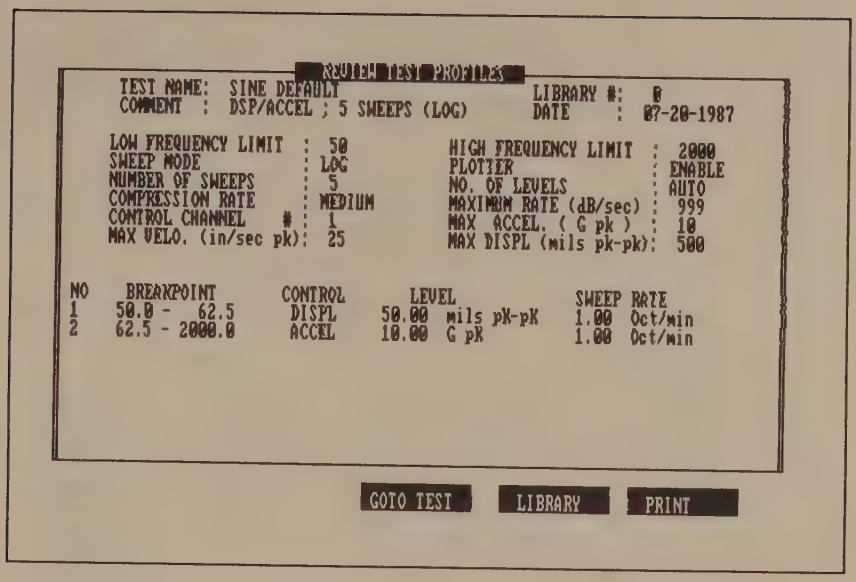

REVIEW TEST PROFILES
TEST NAME: SINE DEFAULT
COMMENT : DSP/ACCEL ; 5 SWEEPS (LOG)
LIBRARY #: 0
DATE : 07-20-1987
LOW FREQUENCY LIMIT : 50
SWEEP MODE : LOG
NUMBER OF SWEEPS : 5
COMPRESSION RATE : MEDIUM
CONTROL CHANNEL # : 1
MAX VELO. (in/sec pk): 25
HIGH FREQUENCY LIMIT : 2000
PLOTTER : ENABLE
NO. OF LEVELS : AUTO
MAXIMUM RATE (dB/sec) : 999
MAX ACCEL. (G pk) : 10
MAX DISPL (mils pk-pk): 500
NO BREAKPOINT CONTROL LEVEL SWEEP RATE
1 50.0 - 62.5 DISPL 50.00 mils pk-pk 1.00 Oct/min
2 62.5 - 2000.0 ACCEL 10.00 G pk 1.00 Oct/min
GOTO TEST
LIBRARY
PRINT

Figure 4-5. Review of the Test File Parameters

selected sine database file before proceeding. Pressing "GOTO TEST", displays the test screen of Figure 4-6 to ready the selected sine profile for operation.

Pressing "LIBRARY" redisplays the previous library menu screen of Figure 4-4, to allow an easy exit to select another sine profile. Pressing "PRINT" enables the print screen routine to print the entire screen display on a dot matrix printer such as the DMP-100. Note, this "PRINT" soft key function does not cause a video printer such as the VMP-100 to print. Printers other than a dot matrix printer require that they be triggered locally. They have the added advantage of not requiring any host processor overhead.

4.3 TEST MODULE DISPLAY AND OPERATION

After the initial power up sequence, the default database is readied to run with a screen display similar to that shown in Figure 4-2. After the initial power up sequence, a sine test profile is always selected by the use of the library menu Figure 4-4. The chosen file parameters are displayed for review, Figure 4-5. If "GOTO TEST" is pressed, then the test screen of Figure 4-6 is displayed. The host processor does a preliminary diagnostic check to verify that the Sine Controller Board exists in the system and then initiates a self calibration check. A sequence of messages will appear on the screen within the message block of the test screen. First, the message "CONTROLLER CHECK" will display, to be replaced briefly by "LOADING CONTROLLER". The message block will then clear until the

"OUTPUT" soft switch is pressed. When the "OUTPUT", soft switch #1, is pressed or the REMOTE START input is selected, the previous series of messages will again be displayed followed by a "SOFTSTART" message. This message will display until the control level is reached and then clears.

The message block is located directly above the "mode" block at the bottom left hand corner, see Figure 4-6. The messages are to inform the user of what is taking place.

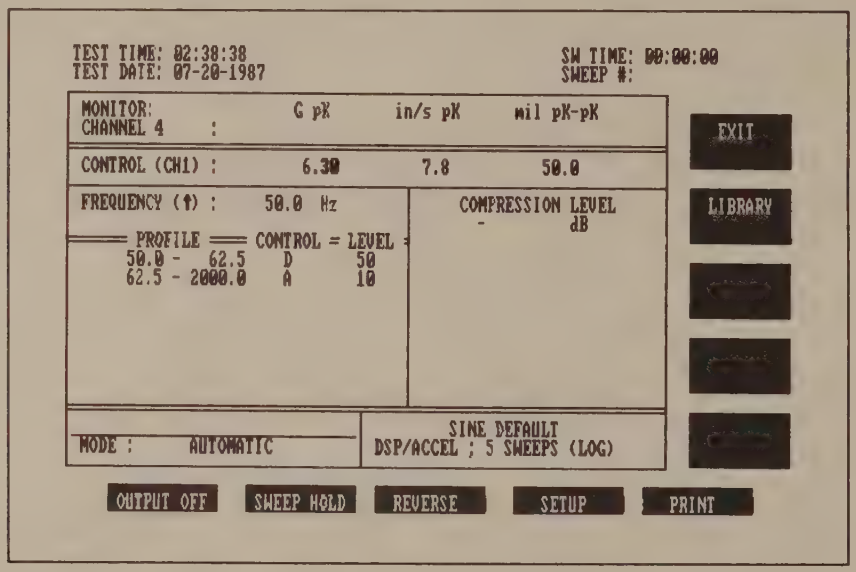


Figure 4-6. Test Screen

Soft switches "EXIT" and "LIBRARY" will be blanked out at this time and are not available until the sine test is aborted or completed. Either the "OUTPUT" soft switch or the red "ABORT" switch may be used to terminate the sine test profile in progress.

4.3.1 Control and Monitor Channel Display

After "GOTO TEST" is selected the screen display will appear as in Figure 4-6 with the control channel displaying values using bright highlighted numbers. These values correspond to the anticipated initial levels for the first breakpoint. The monitor channel remains blank until the "OUTPUT" soft key is pressed to "OUTPUT ON". The control channel 1 will display the current control or servo level using bright highlighted numbers. Depending on the current control level, acceleration, velocity or displacement will be displayed. The remaining two uncontrolled parameters will be displayed at a normal intensity level. For example, if displacement is the control parameter then dis-

placement will be highlighted and acceleration and velocity will be displayed at normal intensity. The monitor channel 4 is always displayed at normal intensity and is available for easy monitoring of the acceleration, velocity and displacement at some remote uncontrolled accelerometer location. The profile breakpoint levels are summarized on the test screen for ready reference for comparison with the current control levels. The frequency display is a four digit display of the current sweep frequency with the sine sweep direction indicated by an up/down arrow. Pressing "PRINT", if available, enables the print screen routine to print a copy of the displayed sceen on a dot matrix printer such as the DMP-100, if connected.

The monitor channel makes use of an analog true rms convertor and its output is sampled and digitized to provide the monitor channel acceleration level. The velocity and displacement are calculated from this measured acceleration level. Because of the use of the analog true rms convertor, the displayed levels for the monitor display, channel four, may lag behind that of the control channel at fast sweep rates or with sudden changes in acceleration. The control channel levels are completely the result of the sampled time domain waveforms that are digitally filtered using a narrow band tracking filter and integrated to obtain the desired control and displayed response.

4.3.2 Display Functions

The remaining display parameters in Figure 4-6 are frequency, sweep direction and compression level. These parameters are updated as the sine sweep progresses. The sweep direction arrow, located next to the FREQUENCY display, changes orientation either UP or DOWN depending on the present sweep direction. Note that, the displayed date and time are the starting date and time of the test.

4.4 SOFT KEY SWITCH DESCRIPTION FOR THE TEST SCREEN

For the following switch descriptions refer to Figure 4-6.

4.4.1 Switch No. 1 - Output ON/OFF

This soft switch toggles the sine controller servo either ON or OFF, A soft start or soft shutdown is initiated using the current sine profile. The soft switch also performs as a restart to restart the sine test profile at the first breakpoint and resets the loop count and elapsed time.

4.4.2 Switch No. 2 - Sweep HOLD/ON

This soft switch controls the sine sweep progress. When "SWEEP HOLD" is displayed, the Sine Sweep is held indefinitely at the

currently displayed frequency. When "ON", the sweep rate is defined by the user's sine profile database for each breakpoint or control level. The progress of the sweep frequency is indicated by the bright, highlighted four digit frequency display with an up or down arrow that indicates the sweep direction. The analog X-Y plotter output is active while "SWEEP ON" is indicated.

4.4.3 Switch No. 3 - REVERSE

This soft switch reverses the direction of the sweep while a sine sweep test is in progress. The direction of the sweep is indicated by either an up or down arrow, located next to the frequency display.

4.4.4 Switch No. 4 - SETUP

This soft switch causes a previously stored display of the SETUP SCREEN to be redisplayed for review of the database parameters not currently displayed on the test screen.

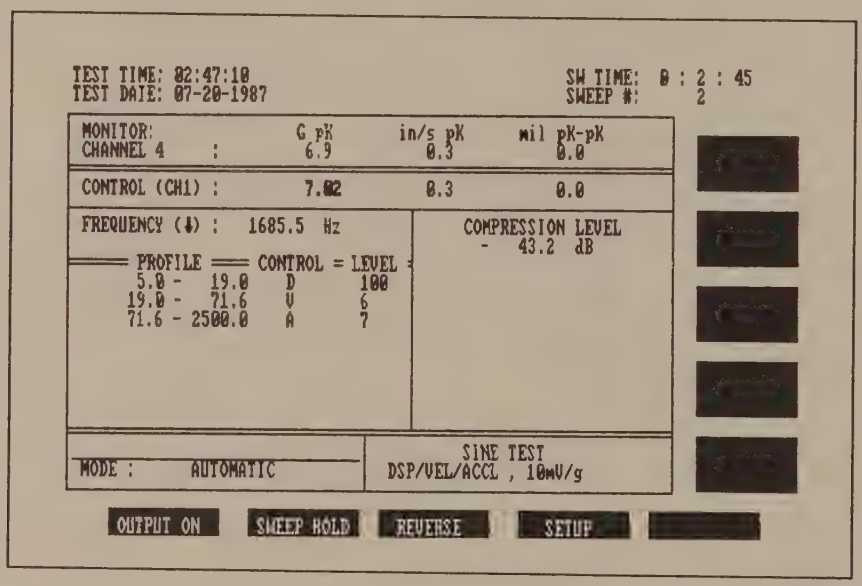


Figure 4-7. Sine Sweep Test In Progress

4.4.5 Switch No. 5 - PRINT

This soft switch activates a dot matrix printer such as the DMP-100, if connected, to print a copy of the current screen image. This function is only available before and after a sine test with switch No. 1 displaying "OUTPUT OFF". The "PRINT" soft key is blank when the "OUTPUT ON" is displayed, see Figure 4-7.

4.4.6 Switch Numbers 6,7 and 8 are reserved for future functions and remain blank.

4.4.7 Switch No. 9 - LIBRARY

Allows the user to go to the library menu and select another sine test profile. This soft switch is blank while a sine test is in progress.

4.4.8 Switch No. 10 - EXIT

Allows the user to exit the current test mode altogether and return to the main menu. This soft switch is blank while a sine test is in progress.

4.5 SOFT KEY SWITCH DESCRIPTIONS FOR THE REVIEW OF THE SETUP SCREEN

If "SETUP", soft switch #4, is pressed while the test screen of Figures 4-6 or 4-7 are present a stored image of the setup file is displayed. If the sine controller is controlling a sweep then a display similar to Figure 4-8 will be shown. This screen display is for instant review of the setup parameters created with the editor. Note, that only one soft switch is active while a sine test is in operation. When the sine test is complete or not controlling then two soft switches will be present.

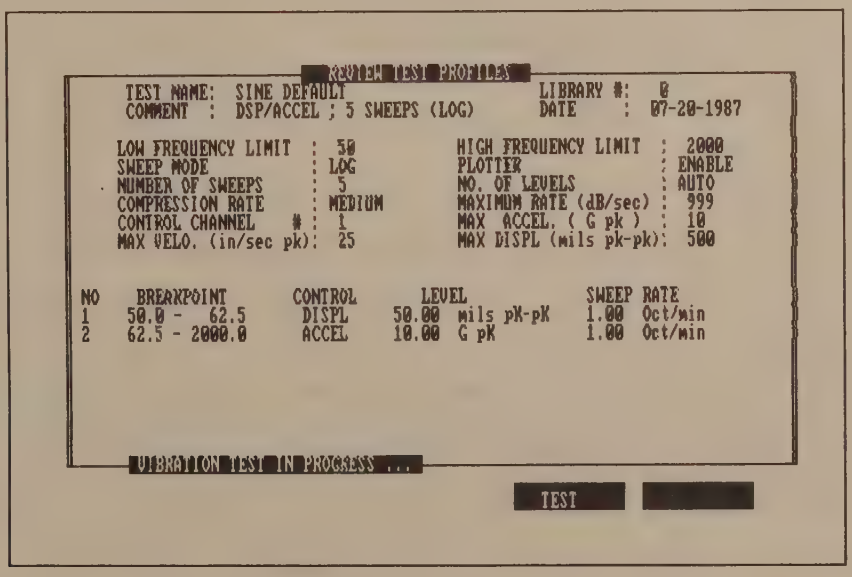

REVIEW TEST PROFILES
TEST NAME: SINE DEFAULT
COMMENT : DSP/ACCEL ; 5 SWEEPS (LOG)
LIBRARY #: 0
DATE : 07-20-1987
LOW FREQUENCY LIMIT : 50
SWEEP MODE : LOG
NUMBER OF SWEEPS : 5
COMPRESSION RATE : MEDIUM
CONTROL CHANNEL # : 1
MAX VELO. (in/sec pk): 25
HIGH FREQUENCY LIMIT : 2000
PLOTTER : ENABLE
NO. OF LEVELS : AUTO
MAXIMUM RATE (dB/sec) : 999
MAX ACCEL. (G pk) : 10
MAX DISPL (mils pk-pk): 500
NO BREAKPOINT CONTROL LEVEL SWEEP RATE
1 50.0 - 62.5 DISPL 50.00 mils pK-pK 1.00 Oct/min
2 62.5 - 2000.0 ACCEL 10.00 G pK 1.00 Oct/min
VIBRATION TEST IN PROGRESS ...
TEST

Figure 4-8. Typical Review of the Edit Screen

4.5.1 Switch No. 4 - TEST

This soft switch returns the user to the test screen display, Figure 4-6, 4-7.

4.5.2 Switch No. 5 - PRINT

This soft switch is only available when the sine controller is not actively controlling.

4.6 MAIN MENU

The main menu screen display is the menu from which the different options on the DCS-7000 SR Sine Controller are selected. Five options are available as shown in Figure 4-9 and described below.

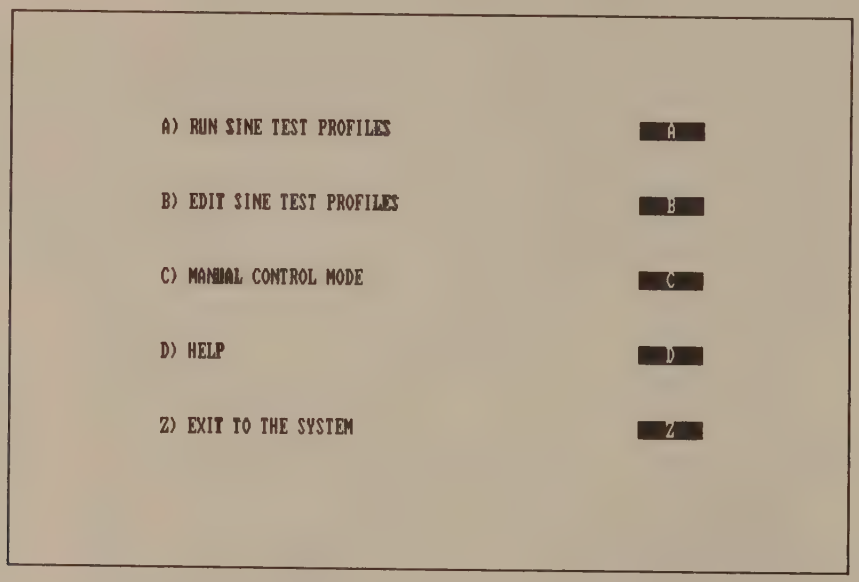


Figure 4-9. Main Menu Display

4.6.1 Option A - Run Sine Test Profiles

This option is used to run or review an existing sine test profile from the "B" disk drive. The sine test profiles chosen are for running a completely automatic sine profile test. All sine profile selections are chosen from the "TEST FILE LIBRARY" of Figure 4-4.

4.6.2 Option B - EDIT SINE TEST PROFILES

This option is used to edit, review or create new sine test profiles. The sine test profile library file number is chosed from the EDIT SINE PROFILE" menu. This menu uses the same sine

test database files from the "B" disk drive as does the "TEST FILE LIBRARY" menu. When a file selection is made the editor screen of Figure 4-13 is displayed.

4.6.3 Option C - Manual Control

This option is used for complete manual control of the DCS-7000 SR Sine Controller, Figure 4-11. The charge amplifier and accelerometer Calibration may be checked and set using this mode. Also, a test article or shaker transfer function maybe plotted.

4.6.4 Option D - Help

This option is for a quick on-line reference to the main menu selections.

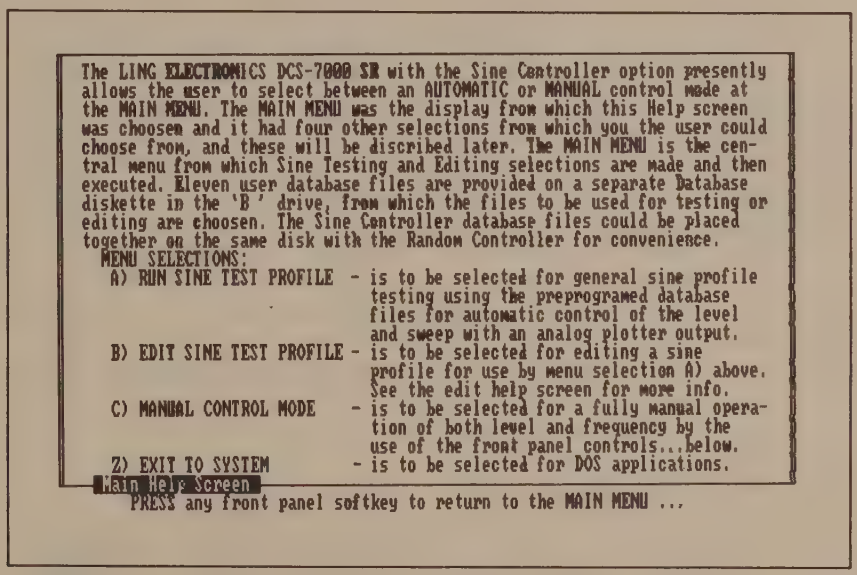

The LING ELECTRONICS DCS-7000 SR with the Sine Controller option presently allows the user to select between an AUTOMATIC or MANUAL control mode at the MAIN MENU. The MAIN MENU was the display from which this Help screen was choosen and it had four other selections from which you the user could choose from, and these will be discribed later. The MAIN MENU is the central menu from which Sine Testing and Editing selections are made and then executed. Eleven user database files are provided on a separate Database diskette in the 'B' drive, from which the files to be used for testing or editing are choosen. The Sine Controller database files could be placed together on the same disk with the Random Controller for convenience.
MENU SELECTIONS:
A) RUN SINE TEST PROFILE - is to be selected for general sine profile testing using the preprogramed database files for automatic control of the level and sweep with an analog plotter output.
B) EDIT SINE TEST PROFILE - is to be selected for editing a sine profile for use by menu selection A) above. See the edit help screen for more info.
C) MANUAL CONTROL MODE - is to be selected for a fully manual operation of both level and frequency by the use of the front panel controls...below.
Z) EXIT TO SYSTEM - is to be selected for DOS applications.
Main Help Screen
PRESS any front panel softkey to return to the MAIN MENU ...

Figure 4-10. Main Menu Help Screen

4.6.5 Option Z - Exit to the System

This option allows the user to exit the present sine controller program to run other DOS applications. To run the DCS-7000 SR Random Controller, if available, replace the existing diskettes in the 'A' and 'B' drives with those of the Random Controller and type "TEST" at the DOS "A>" prompt. If the Sine Controller is needed, again type "SINE" at the DOS "A>" prompt with the appropriate diskettes.

4.7 MANUAL CONTROL MODE

This mode is selected from the main menu for calibration and check out of the charge amplifier, accelerometer and system transfer function. General system test and checkout can also be performed. The manual control mode does not require a sine profile to be selected, and allows the full use of the operating spectrum from 5Hz to 6500 Hz. Initially the manual mode control is set with 5.0 Hz as the starting frequency and the compressor is at full compression, 80 dB or greater, see Figure 4-11.

The manual control mode allows full control of frequency and compression level to the operator with a broad band rms level response input. The operator adjusts the frequency and compression level by the use of the two front panel controls labeled "FREQUENCY" and "LEVEL". These controls are located on the control panel of Figure 3-1. The "FREQUENCY" and "LEVEL" controls are utilizing high resolution optical encoders in conjunction with a rate sensitive adjustment algorithm. Because of this, the "FREQUENCY" and "LEVEL" controls function as multiturn potentiometers without stops, and separate coarse and fine adjustment controls. Thus, slowly turning the controls increments the frequency or compression level slowly, and the faster the rate of change, then even faster the frequency or level changes. The controls may also be suddenly flicked, to make very rapid changes in frequency and level. The methods employed utilizing the optical encoders are to provide the user a simple analog type control without the reliability characteristics of a resistive potentiometer.

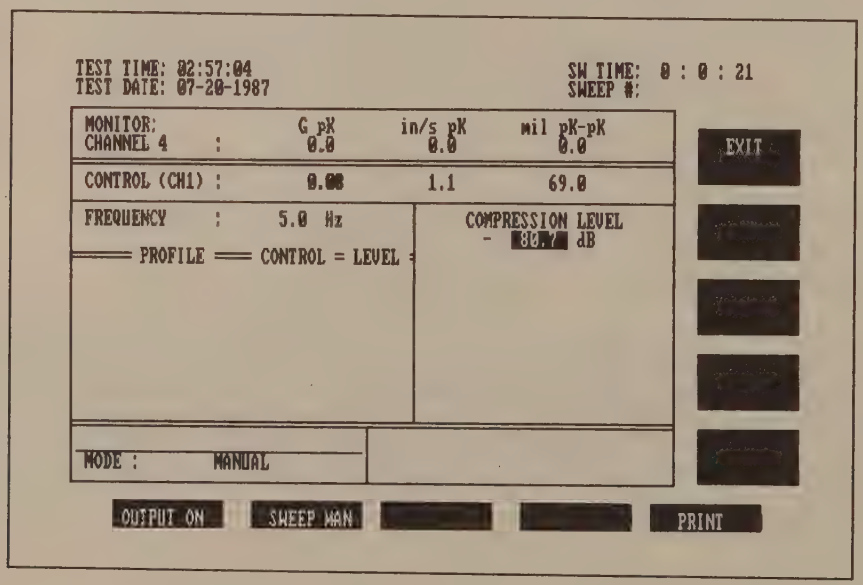


Figure 4-11. Initial Manual Control Screen

4.7.1 Manual Frequency and Level Control Use

The "FREQUENCY" and "LEVEL" controls are to be adjusted one at a time with the controlled parameter being displayed in reverse video, see Figure 4-11. For example, when the "LEVEL" control is adjusted the compression "dB" level is in reverse video and the acceleratrion level is highlighted with bright characters. When the "FREQUENCY" control is adjusted the frequency is displayed in reverse video and the compression dB level is displayed normally.

If the "LEVEL" control is again used, the display sequence again switches.

By adjusting the "LEVEL" control the user can set the desired acceleration level at a certain frequency and observe the acceleration, velocity and displacement levels all at once. Note, though, that the velocity and displacement levels are not updated while the frequency or acceleration levels are changing while the front panel controls are in use. Once the front panel controls are at rest, then, all display levels and the monitor channel are updated continuously. The analog X-Y plotter output is continuously active with the pen lift in the down position so a plot of the control channel response may be made.

4.7.2 Calibration of the Analog Plotter

The manual control mode can also be used to set up the analog plotter X and Y scales. The analog plotter is set up depending on the type of log/log paper used by adjusting the frequency and level controls to the lowest profile level and frequency to be used and setting the analog X-Y plotter X and Y zero adjustments. Then change the frequency and level controls to the maximum profile and acceleration level used and adjusting the analog plotter x and y axis vernier gain controls. The acceleration level adjustment usually only needs to be adjusted over a 20 dB range to accurately set an analog plotter. This procedure may need to be repeated about three times to accurately set the analog X-Y plotter scales.

The rear panel analog plotter (J19) connector output connections are:

Pin	Description
1 to 5	Common
6	DC proportional to the Log of the frequency out (+ 5 V dc max.)
7	DC proportional to the Log of the acceleration out (+ 5 V dc max.)
8	$\overline{\text{Pen Lift}}$, TTL compatible normally + 5 V
9	Pen Lift, TTL compatible normally ≈ 0 V

(THIS PAGE INTENTIONALLY BLANK)

SECTION 5

EDIT MODULE

5.1 PURPOSE

The Edit Module is used to create or modify sine test databases. The user is prompted at the "MESSAGE LINE", shown in reverse video below the main EDIT screen of Figure 5-2, as to the next selection format. The Edit Module also provides a quick on-line Help Screen for information regarding the sine database parameters. All database files to be edited are chosen from an Edit File Library Menu in the same fashion that the Test File Library selections are made, for quick access and easy file reference. Upon saving a file the displayed file date is automatically updated.

5.2 ENTERING AND EXITING THE EDIT MODULE

To enter the Edit Module, in order to create or modify a sine test database or to access the Edit Module's Help Screen, it is necessary to have the keyboard connected.

CAUTION

Do NOT connect or disconnect the keyboard while power is applied to the System. Damage to the keyboard or System Unit may occur.

The keyboard may remain connected while the System is operating in any mode but all keyboard inputs are ignored when operating in the Test Module.

If power is applied, and the keyboard is disconnected, turn the power switch to OFF, and follow the instructions in Subsections 4.1 and 4.6 to obtain the Main Menu. The Main Menu may also be accessed by pressing F3 on the keyboard while in the Edit Module, or by pressing the "EXIT" soft switch in the Test Module.

With the Main Menu displayed, press the "B" key on the keyboard or the "B" soft key to first load the Edit Library and display the eleven database files. Figure 5-1 shows a typical display of the Edit Library Menu. A selection is made by moving the blinking cursor next to the desired file or selection using either the up/down arrow, soft keys or cursor keys on the

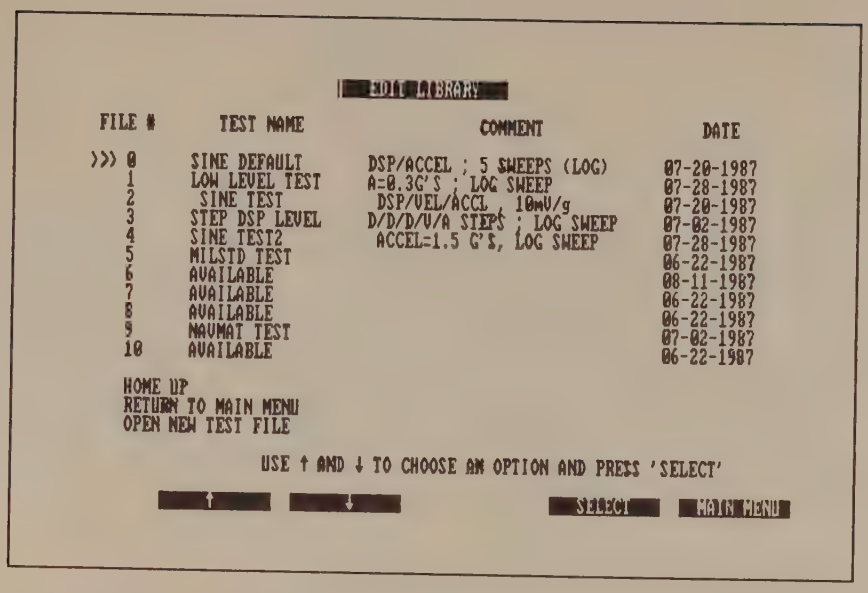

EDIT LIBRARY
FILE #
TEST NAME
COMMENT
DATE
>>> 0 SINE DEFAULT DSP/ACCEL ; 5 SWEEPS (LOG) 07-20-1987
1 LOW LEVEL TEST A=0.3G'S ; LOG SWEEP 07-28-1987
2 SINE TEST DSP/VEL/ACCL , 10mV/g 07-20-1987
3 STEP DSP LEVEL D/D/D/U/A STEPS ; LOG SWEEP 07-02-1987
4 SINE TEST2 ACCEL=1.5 G'S, LOG SWEEP 07-28-1987
5 MILSTD TEST 06-22-1987
6 AVAILABLE 08-11-1987
7 AVAILABLE 06-22-1987
8 AVAILABLE 06-22-1987
9 NAVMAT TEST 07-02-1987
10 AVAILABLE 06-22-1987
HOME UP
RETURN TO MAIN MENU
OPEN NEW TEST FILE
USE ↑ AND ↓ TO CHOOSE AN OPTION AND PRESS 'SELECT'
↑
↓
SELECT
MAIN MENU

Figure 5-1. Typical Edit Library File Menu Display

keyboard. The Sine database file selection is made by pressing either the "SELECT" soft key or the ENTER or RETURN keys at the keyboard. The file selection will next appear displaying all the database parameters as illustrated by Figure 5-2.

5.2.1 Creating or Replacing a Database File

If a sine database file is possibly partly damaged in some way or a completely fresh database is to be created onto a newly formated diskette, then, position the cursor before the "OPEN NEW TEST FILE" selection. Press the ENTER or RETURN key from the keyboard. Answer the prompts and a new database file with a low, one "g" level, profile will be created as a default level for any of the eleven database files. After the new file is created the Edit File Library menu screen will be redisplayed.

5.2.2 Other Library Menu Functions

The "HOME UP" and "MAIN MENU" selections serve the same purpose as on the Test File Library menu screen, Figure 4-4.

5.3 EDITING FUNCTIONS AVAILABLE IN THE EDIT MODULE

After a sine profile has been chosen for editing, Figure 5-2, the following keyboard keys are available to aid in moving about the screen so that changes can be easily made. The "MESSAGE LINE" located below the EDIT screen prompts the user with the keyboard keys available for editing.

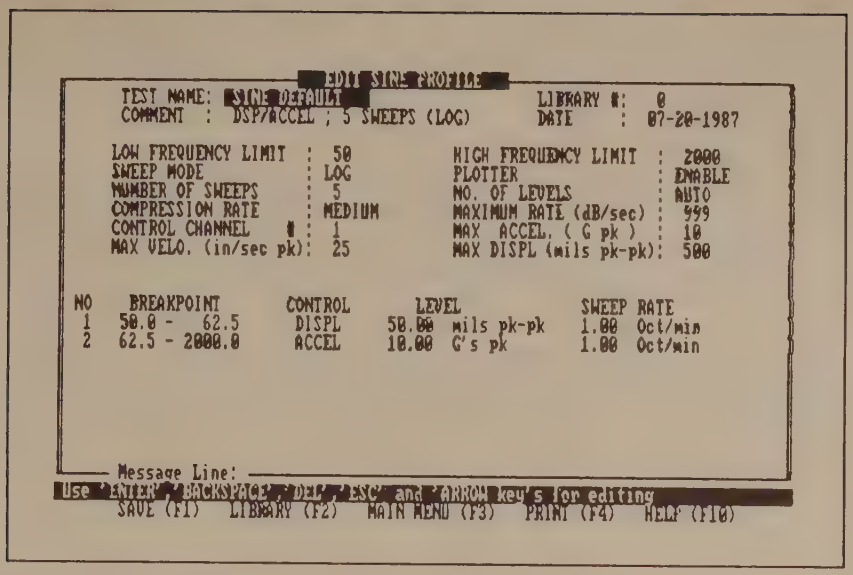

EDIT SINE PROFILE
TEST NAME: SINE DEFAULT
COMMENT : DSP/ACCEL ; 5 SWEEPS (LOG)
LIBRARY #: 0
DATE : 07-20-1987
LOW FREQUENCY LIMIT : 50
SWEEP MODE : LOG
NUMBER OF SWEEPS : 5
COMPRESSION RATE : MEDIUM
CONTROL CHANNEL # : 1
MAX VELO. (in/sec pk): 25
HIGH FREQUENCY LIMIT : 2000
PLOTTER : ENABLE
NO. OF LEVELS : AUTO
MAXIMUM RATE (dB/sec) : 999
MAX ACCEL. (G pk) : 10
MAX DISPL (mils pk-pk): 500
NO BREAKPOINT CONTROL LEVEL SWEEP RATE
1 50.0 - 62.5 DISPL 50.00 mils pk-pk 1.00 Oct/min
2 62.5 - 2000.0 ACCEL 10.00 G's pk 1.00 Oct/min
Message Line:
Use "ENTER", "BACKSPACE", "DEL", "ESC" and "ARROW key's for editing
SAVE (F1) LIBRARY (F2) MAIN MENU (F3) PRINT (F4) HELP (F10)

Figure 5-2. Typical Edit File Display with Parameters

The screen is divided into two parts. The upper part displays the Parameter fields while the lower part displays the Breakpoint fields.

5.3.1 Cursor Movement Keys

The cursor is a reverse video rectangle identifying the current parameter to be edited. When the Edit Module is first entered, the cursor is located at the top of the Edit screen at the "TEST NAME" position, Figure 5-2.

The cursor may be moved about the database display to edit any parameter. The cursor movement keys are the up, down, left, and right arrow keys plus the "Pg Dn" (PAGE DOWN) key, all located on the numeric keypad of the keyboard. For numeric entries, use the top row of numbers from the alphanumeric portion of the keyboard or press the "Num Lock" key to use the numeric keypad to the right.

The up and down arrow keys are used to move the cursor line by-line, up and down the display. The left and right arrow keys are used to move the cursor horizontally through the sine profile parameters in sequential order. The "Pg Dn" key moves the cursor from any line directly to the first breakpoint line located halfway down the CRT screen display.

When the cursor is located in the bottom half of the screen for breakpoint parameter entry, the left and right arrow keys move it left and right sequentially between parameters. When the

cursor is at the rightmost parameter, the right arrow key moves it directly to the leftmost parameter on the following breakpoint; when at the leftmost parameter, the left arrow key moves it directly to the rightmost parameter of the previous line or breakpoint.

The breakpoint lines have more than one parameter associated with each line. After new data is entered for the Control parameter on one of these lines, the cursor automatically moves to the control level parameter associated with the line. For example: if sine Control type is selected (1,2,or 3), then the corresponding parameter, acceleration (1), velocity (2) or displacement (3) is automatically selected and cursor advances automatically to the Control Level column. After new data has been entered for the last parameter associated with that line, the cursor moves to the beginning of the next line or breakpoint.

5.3.2 ENTER/RETURN Key

The ENTER key on the keyboard is used to validate and cause the editor to accept the entries made for the selected parameters that have numeric or alpha character fields. After new data has been entered into a parameter field, the new data is accepted by the editor after the ENTER key is pressed. The cursor then increments to the next parameter to the right for a given parameter or breakpoint line. If the cursor is at the rightmost parameter then the cursor will move to the leftmost parameter of the following line. The ENTER key can be used like the right arrow key to sequentially step from left to right and validate the sine profile parameter or breakpoint selections.

5.3.3 Backspace (<--) and Delete (DEL) Keys

These keys are to be used for single character corrections of the parameter or breakpoint fields that have more than one character. Examples of multiple character entries are: Test Name, Comments, Low frequency Limit, High Frequency Limit, Number of Sweeps, Maximum Compression Rate and so on. The "backspace" and DEL keys are used only to edit the parameter or breakpoint fields that are in the process of being revised.

The "backspace" key differs from the DEL key in that the "backspace" key allows the new field data to be deleted entirely and then allows an exit to the parameter field to the left. If this is done, the previous parameter or Breakpoint field retains its old value. The DEL key only allows corrections within a modified Parameter or Breakpoint field.

5.3.4 Page Down Key (Pg Dn)

This key is used to enter the lower half of the EDIT screen for

quick editing of the breakpoints. The editor is placed in the auto-breakpoint caculator or manual edit modes based on what the
current "No. of LEVELS" field is set to. The "No. of LEVELS" parameter field can be the number of breakpoints from 1 to 8 or "AUTO" for auto-breakpoint calculator. The breakpoint parameters can be edited by providing the necessary changes and validating the new breakpoint information by pressing the ENTER key. The left and right arrow keys move the cursor about the breakpoint parameters.

The use of the "Pg Dn" key was provided basically to make quick modifications to the breakpoint parameters such as sweep rate or breakpoint levels. The ESC key can also be used to exit to the Parameter fields above the Breakpoints for modification of the system parameters, compression rate and so on. The breakpoint parameters may be re-entered for further modification if necessary. The manual and auto-breakpoint calculator edit modes are discussed in more detail later on.

5.3.5 Escape Key (ESC)

This key has two basic functions depending on where the cursor is on the EDIT screen. The ESC key is basically an "UNDO" key, that is, if ESC is pressed after new data has been typed into a multi-character Parameter or Breakpoint field and the new data has not been accepted or validated as yet by previously pressing the ENTER key then the old data will be returned. The cursor will increment to the next parameter field to the left if the cursor is in the upper half of the edit screen. If the cursor is in the lower half of the EDIT screen or Breakpoint parameters, the ESC key is used to exit the "auto-breakpoint calculator" mode. The cursor is then moved to "TEST NAME". If the manual breakpoint mode is active then the breakpoint parameter that has been modified but not validated with the ENTER key. When the ESC key is pressed, the cursor moves to the "MAX DISPL (mils pk-pk)" system parameter. The ESC key is therefore used to undo a parameter change or return the original value when used within the parameter fields portion of the screen. Within the lower half of the screen it is used to cancel or exit from editing the breakpoint parameters.

5.4 BREAKPOINT EDITING

5.4.1 Manual Breakpoint Editing

The lower half of the Edit screen is for the entry of the sine profile breakpoint parameters. Manual entry of breakpoints is selected by specifying the number of levels at "No. of LEVELS" parameter at the upper half of the edit screen, see Figure 5-3. The message line, as illustrated in Figure 5-3, prompts the user

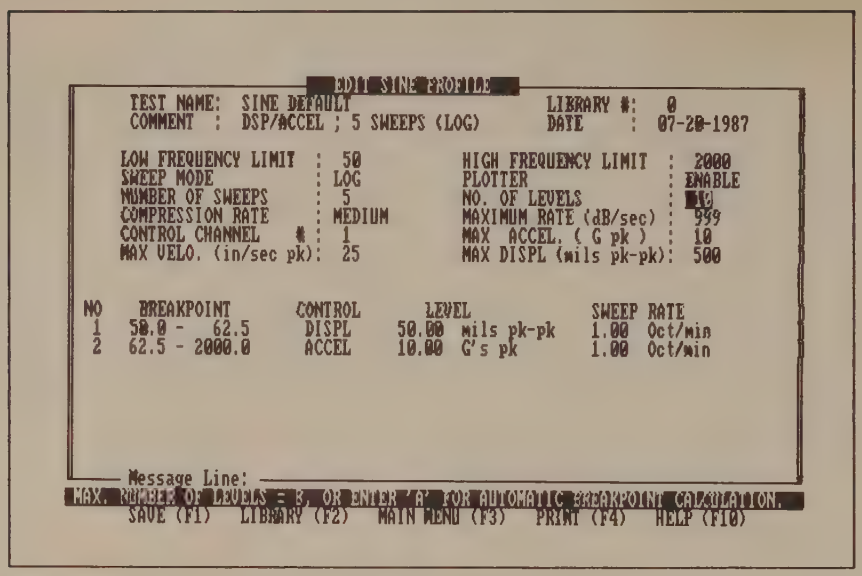

EDIT SINE PROFILE
TEST NAME: SINE DEFAULT
LIBRARY #: 0
COMMENT : DSP/ACCEL ; 5 SWEEPS (LOG)
DATE : 07-20-1987
LOW FREQUENCY LIMIT : 50
HIGH FREQUENCY LIMIT : 2000
SWEEP MODE : LOG
PLOTTER : ENABLE
NUMBER OF SWEEPS : 5
NO. OF LEVELS : 2
COMPRESSION RATE : MEDIUM
MAXIMUM RATE (dB/sec) : 999
CONTROL CHANNEL # : 1
MAX ACCEL. (G pk) : 10
MAX VELO. (in/sec pk): 25
MAX DISPL (mils pk-pk): 500
NO BREAKPOINT CONTROL LEVEL SWEEP RATE
1 50.0 - 62.5 DISPL 50.00 mils pk-pk 1.00 Oct/min
2 62.5 - 2000.0 ACCEL 10.00 G's pk 1.00 Oct/min
Message Line:
MAX. NUMBER OF LEVELS = 8, OR ENTER '0' FOR AUTOMATIC BREAKPOINT CALCULATION.
SAVE (F1) LIBRARY (F2) MAIN MENU (F3) PRINT (F4) HELP (F10)

Figure 5-3. Examples of Choice for Breakpoint Entry

with the choices of selecting from 1 to 8 levels for manual breakpoint entry or to enable the auto-breakpoint calculator to
lator to aid in defining the levels and cross-over frequencies.

The manual breakpoint mode is specified by selecting the exact number of levels to be used at "No. of LEVELS", from 1-8. This mode allows the user to specify discontinuous control levels of acceleration, velocity or displacement. Thus, multiple acceleration levels could be specified as separate breakpoints. The editor will check the crossover frequency with the control type and level, then inform the user if there is a discontinuity. A prompt is then displayed at the message line to accept or correct the discontinuity with a "Y" or "N". If "Y" is selected then the editor will attempt to correct the crossover frequency unless it is an impossible solution, in which case it will display a message within the "MESSAGE LINE" that a crossover violation exists at a specific frequency, which may interfere with a previous breakpoint. Note that only the crossover frequencies may be specified along with the control type, level and sweep rate. The sine profile band width is only specified at the low frequency or high frequency limits as seen in the upper half of the screen. The ESC key can be used to exit those parameters such as the low and high frequency limits or system parameters and then use "Pg Dn" to re-enter the breakpoints to finish modifying the sine profile.

NOTE

It is important to complete all breakpoint lines before saving the sine profile database. That is, none of the breakpoint parameters are equal to zero and that the displacement is not less than 1 mil pk-pk or that none of the control levels go below 0.2 g peak.

Sweep rates may have different values for each breakpoint level. The only precaution is that the log or linear sweep rates does not sweep faster than the lowest frequency by 0.2 times for velocity control or 0.1 times for displacement control.

For example:

The "SWEEP MODE" is set to linear.
The first breakpoint frequency is 5.0 Hz.
The Control type is displacement.

Thus the maximum sweep rate for the first breakpoint should be no greater than

5.0 Hz x 0.1 = 0.5 Hz/sec.

The following breakpoints that are at frequencies greater than 12.8 Hz can be set faster but this sweep speed limit rule should still be applied.

Once all the breakpoint levels and parameters have been entered and each breakpoint is complete, press the ESC key to exit. Now the sine database may be saved to the "B" disk by pressing the F1 key.

NOTE

If the sweep mode, low frequency limit, high frequency limit or the number of levels is changed it becomes necessary that the breakpoint parameters be revalidated or changed as required by pressing the ENTER key for each parameter.

If, after reaching the last breakpoint line, a discontinuity between levels exists, the message

"DISCONTINUITY AT LEVEL No. 1 TO 2 TRANSITION, [PRESS ANY KEY..]"

will be displayed. This message will continue to blink until a key is pressed, at which time, if more discontinuities follow then user will be informed of each one. The editor then allows you to continue.

5.4.2 Auto-breakpoint Calculator Entry

The Auto-breakpoint Calculator entry mode is selected by entering "A" at the "No. of LEVELS" parameter on the upper portion of the screen. The parameter field at "No. of LEVELS" will now display "AUTO" and the cursor will advance to the "COMPRESSION RATE" field. The bottom half of the screen, with the breakpoint levels, is cleared in anticipation of new breakpoint information. The old breakpoint levels are retained in memory and are redisplayed as default values when the ENTER key is pressed.

The auto-breakpoint calculator determines the exact crossover frequency rounded to a tenth of a hertz between any two breakpoint levels. The crossover frequency is not determined until the last control level has been entered. Note that, while in this mode, the user cannot specify the crossover frequency but only the control type, levels and sweep rates. Also, no discontinuities in levels may exist nor the specification of two of the same acceleration level or control types.

Impossible solutions or violations of the user programmable system limits (i.e. MAX ACCEL, MAX VELO and MAX DISPL) will be announced within the message line. Limits and parameter ranges selections will also be displayed within the message line as progress is made on the edit screen.

When the cursor is first moved to the breakpoint levels by using the cursor keys or the "Pg Dn" key, the cursor is placed at CONTROL type. Enter the appropriate answer by typing 1 (ACCEL), 2 (VEL) or 3 (DISPL) as indicated by the message line, see Figure 5-4.

Sweep rates may have different values for each breakpoint level. The only precaution is that the log or linear sweep rates does not sweep faster than the lowest frequency by 0.2 times for velocity control or 0.1 times for displacement control.

For example:

The "SWEEP MODE" is set to linear.
The first breakpoint frequency is 5.0 Hz.
The Control type is displacement.
Thus the maximum sweep rate for the first breakpoint should be no greater than

5.0 Hz x 0.1 = 0.5 Hz/sec.

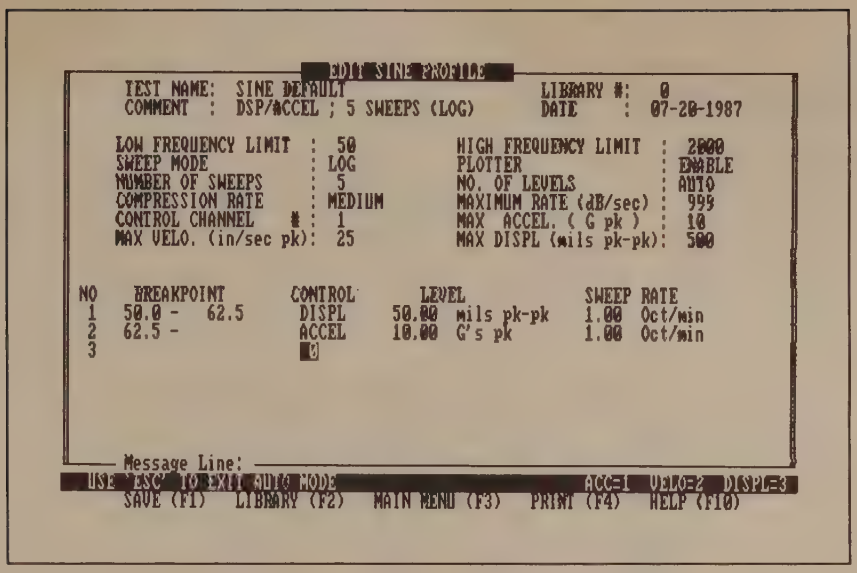

EDIT SINE PROFILE
TEST NAME: SINE DEFAULT
LIBRARY #: 0
COMMENT : DSP/ACCEL ; 5 SWEEPS (LOG)
DATE : 07-20-1987
LOW FREQUENCY LIMIT : 50
HIGH FREQUENCY LIMIT : 2000
SWEEP MODE : LOG
PLOTTER : ENABLE
NUMBER OF SWEEPS : 5
NO. OF LEVELS : AUTO
COMPRESSION RATE : MEDIUM
MAXIMUM RATE (dB/sec) : 999
CONTROL CHANNEL # : 1
MAX ACCEL. (G pk) : 10
MAX VELO. (in/sec pk): 25
MAX DISPL (mils pk-pk): 500
NO BREAKPOINT CONTROL LEVEL SWEEP RATE
1 50.0 - 62.5 DISPL 50.00 mils pk-pk 1.00 Oct/min
2 62.5 - ACCEL 10.00 G's pk 1.00 Oct/min
3
Message Line:
USE 'ESC' TO EXIT AUTO MODE
ACC=1 VELO=2 DISPL=3
SAVE (F1) LIBRARY (F2) MAIN MENU (F3) PRINT (F4) HELP (F10)

Figure 5-4. Single Character Entry Example

The following breakpoints that are at frequencies greater than 12.8 Hz can be set faster but this sweep speed limit rule should still be applied.

Once all the breakpoint levels and parameters have been entered and each breakpoint is complete, press the ESC key to exit. Now the sine database may be saved to the "B" disk by pressing the F1 key.

> NOTE
>
> If the sweep mode, low frequency limit, high frequency limit or the number of levels is changed it becomes necessary that the breakpoint parameters be revalidated or changed as required by pressing the ENTER key for each parameter.

The breakpoints may be re-entered at any time without reselecting the auto-breakpoint calculator if it is already existing as part of the sine database file. To re-enter, press the "Pg Dn" key and the cursor will be placed at the first breakpoint line or level at CONTROL type. Press the ESC key after completing the entry of the last breakpoint line.

5.4.3 On-line Help Screen

If F10 is pressed at any time the on-line HELP screen is displayed, see Figure 5-5.

This "EDIT HELP SCREEN" is to provide a ready quick reference to the choices and range of parameter values for each given selection. When finished with the HELP screen, simply press F10 again and resume from where the cursor was prior to the selection of the HELP screen.

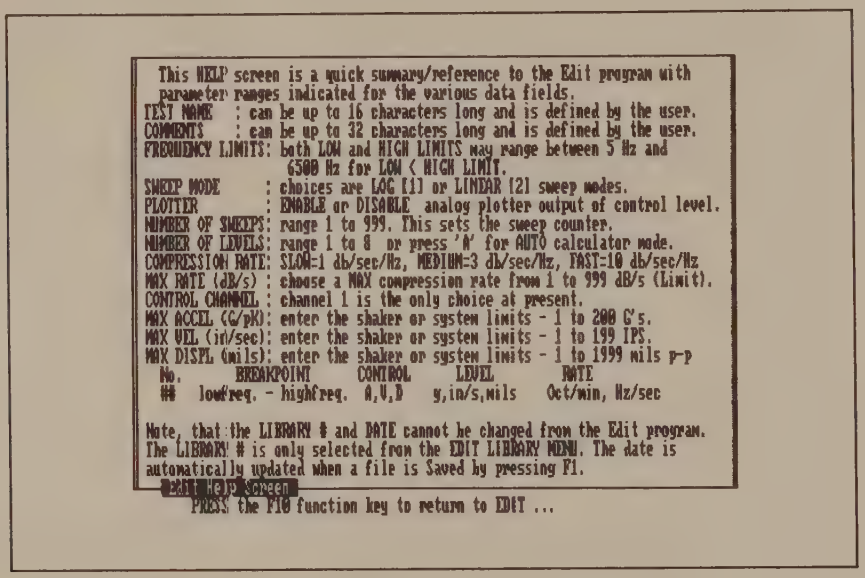

This HELP screen is a quick summary/reference to the Edit program with
parameter ranges indicated for the various data fields.
TEST NAME : can be up to 16 characters long and is defined by the user.
COMMENTS : can be up to 32 characters long and is defined by the user.
FREQUENCY LIMITS: both LOW and HIGH LIMITS may range between 5 Hz and
6500 Hz for LOW < HIGH LIMIT.
SWEEP MODE : choices are LOG [1] or LINEAR [2] sweep modes.
PLOTTER : ENABLE or DISABLE analog plotter output of control level.
NUMBER OF SWEEPS: range 1 to 999. This sets the sweep counter.
NUMBER OF LEVELS: range 1 to 8 or press 'A' for AUTO calculator mode.
COMPRESSION RATE: SLOW=1 db/sec/Hz, MEDIUM=3 db/sec/Hz, FAST=10 db/sec/Hz
MAX RATE (dB/s) : choose a MAX compression rate from 1 to 999 dB/s (Limit).
CONTROL CHANNEL : channel 1 is the only choice at present.
MAX ACCEL (G/pK): enter the shaker or system limits - 1 to 200 G's.
MAX VEL (in/sec): enter the shaker or system limits - 1 to 199 IPS.
MAX DISPL (mils): enter the shaker or system limits - 1 to 1999 mils p-p
No. BREAKPOINT CONTROL LEVEL RATE
low freq. - high freq. A,V,D g,in/s,mils Oct/min, Hz/sec
Note, that the LIBRARY # and DATE cannot be changed from the Edit program.
The LIBRARY # is only selected from the EDIT LIBRARY MENU. The date is
automatically updated when a file is Saved by pressing F1.
PRESS the F10 function key to return to EDIT ...

Figure 5-5. Edit Help Screen

5.4.4 Printing a Copy of the Edit Screen

A copy of the current edit screen display may be made on a dot matrix printer if connected, such as the DMP-100. Pressing F4 on the keyboard will start the print screen function and the message screen will display

"SCREEN PRINTING IN PROGRESS..."

until the printer is finished. This print screen function does not apply to video printers which utilize the video output signals provided at the rear of the DCS-7000SR. Refer to Subsection 3.2 for the composite and RGB video connectors. These video printers require that they be activated locally and have the advantage of not requiring any processor overhead time from the DCS-7000SR.

5.4.5 Exiting to the Main Menu

An exit to the main menu of Figures 4-3 and 4-9 may be made by pressing F3. By exiting to the main menu the edited sine profile may now be used for vibration testing.

5.4.6 Reselecting the Edit Library Menu

Pressing F2 on the keyboard allows an exit from the currently displayed sine profile to select another. The sine database disk can be reviewed at the "EDIT LIBRARY" and another file may be selected from the menu for editing.

5.4.7 Saving a Sine Database File

Pressing F1 on the keyboard causes the editor to save the current contents of the displayed sine profile. This file is saved to the database disk in the "B" drive.

5.5 CREATING AND SAVING A NEW SINE TEST DATABASE

5.5.1 Preliminary Considerations

Before proceeding to create and save a new database, the following factors should be considered and followed:

1. It is advisable to make one or more back-up copies of the LINGFAX Database diskette (and the Program diskette) prior to creating or modifying databases. If this has not been done, see Subsection 5.7 for the procedure to follow.

2. The date and time known by the System are used to update a new database file. If either or both are incorrect, follow the instructions in Subsection 5.8 to correct them.

3. The sine software must be active with the "EDIT LIBRARY" menu displayed, Figure 5-1. The eleven database files can be reviewed from the "EDIT LIBRARY" menu by noting the test name and comments, if any. Each file may then be examined by positioning the blinking cursor and selecting the desired file as described in Subsection 5.2.

4. If the file chosen is the file to be modified then editing may begin immediately by following the instructions outlined in Subsections 5.4 and 5.6.

5. If the file is suspected of being damaged then a new database file may be created to replace the previous one by referring to Subsection 5.2.1. A new set of sine database files may be created for a newly formatted diskette by referring to Subsection 5.2.1.

5.5.2 General Approach

The general approach to creating a new sine test database is to modify the displayed parameter values of an existing database, using the editing functions of Subsection 5.3. Save the new sine database file by pressing

F1 (SAVE) on the keyboard

and then exit back to the "EDIT LIBRARY" menu by pressing

F2 (LIBRARY).

The sine database diskette may be exchanged with another prior to selecting the "EDIT LIBRARY".

In this way, the original database may be used as a guide for entering the new parameter values.

Additional database diskettes may also be edited without having to restart the system. The changing of diskettes in the disk drive is all that is necessary.

As described in Subsection 5.2, the Edit Module is accessed via the Main Menu. When the Edit Module is first entered, the "EDIT LIBRARY" menu is displayed. Anyone of the eleven files may be selected for editing from this menu. However, until a new user becomes more familiar with database parameters and their most appropriate values for a given application, it is suggested that the Default Database be employed as the original one to be modified in the display.

5.5.3 Procedure

Following is a detailed, step-by-step procedure for creating and saving a new test database. The Edit screen has an on-line Help Screen Reference for the parameter changes. To skip a step in the procedure and leave the parameter values unchanged, use the cursor movement and ENTER keys as required. Use the ESC key to return the previous parameter value if an error was made.

1. The cursor is at "TEST NAME":
   Press any key to delete the previous test name; the ENTER key resaves the previous data.
   Type the new name. [Range: 0 - 31 characters and spaces].
   Press ENTER to store the new name and move to the next line.

2. The cursor is at "COMMENTS":
   Press any key to delete the previous comments; the ENTER key resaves previous data.
   Type the new comments. [Range:0-31 characters and spaces].

Press ENTER to store the new comments and move to the next line.

3. The cursor is at "LOW FREQUENCY LIMIT"; as soon as a numerical entry is started the previous frequency is deleted.
Type the new starting frequency. [Range 5 Hz - 6500 Hz].
Press ENTER to store the new value and to advance the cursor to the next parameter.

4. The cursor is at "HIGH FREQUENCY LIMIT"; as soon as a numerical entry is started the previous frequency is deleted.
Type the new end of sweep frequency. [Range 6 Hz-6500 Hz].
Press enter to store the new value and to move to the next line.

5. The cursor is at "SWEEP MODE" (log or linear).
Choose either 1 (log) or 2 (linear) using the numeric keys. The message line prompts for the choice.

The selection of 1 or 2 causes the cursor to advance to the next parameter. Using ENTER or the right arrow key bypasses this selection.

6. The cursor is at "PLOTTER" (enable or disable).
Choose either 1 (disable plotter) or 2 (enable plotter). The message line prompts for the choice.

The selection of 1 or 2 causes the cursor to advance to the next line. Using ENTER or the right arrow keys bypasses this selection.

7. The cursor is at "NUMBER OF SWEEPS".
Type the number of sweeps required. (As soon as a numerical entry is started the previous value is deleted). This sine controller counts either an up or down sweep as a complete sweep beginning with sweep 1. [Range 1 to 999 sweeps].
Press enter to store the new value. The cursor will advance to the next parameter.

8. The cursor is at "No. of LEVELS:".

This is a single character entry selection. Choosing either a number from 1 to 8 levels for manual entry of breakpoint crossover frequencies or an 'A' from the keyboard to enable the auto-breakpoint calculator. The message line at the bottom of the Edit screen prompts the choices. If manual breakpoint entry is chosen then the breakpoints on the screen will be renumbered to include the new levels. If the auto-breakpoint calculator mode was selected then the previous breakpoint display will clear

but will still be retained as default values.

Type selection 1 to 8 or "A". Cursor will advance to the next line.

Using ENTER or the right arrow keys will bypass this selection.

9. The cursor is at "COMPRESSION RATE:"
Choose from 1 (SLOW), 2 (MEDIUM) or 3 (FAST) using the numeric keys. The message line prompts for the choice.

The selection of 1,2 or 3 causes the cursor to advance to the next parameter. Using ENTER or the right arrow keys will bypass this selection.

10. The cursor is at "MAXIMUM RATE (dB/sec)" or Maximum Compression Limit; as soon as a numerical entry is started the previous value is deleted.
Type the new maximum compression limit: [Range 10 - 999 dB/sec]. The suggested limit is typically a 400 dB/sec.
Press ENTER to store the new level and move to the next parameter.

11. The cursor is at "CONTROL CHANNEL #"; this is currently a reminder that channel 1 is the only control channel and is therefore selectable.

Pressing ENTER or the right arrow key causes the cursor to move to the next parameter.

12. The cursor is at "MAX ACCEL (G pk)" or Maximum System Acceleration Limit.

This parameter is for the entry of the maximum acceleration level allowed by the complete sine vibration control system, be it the amplifier, shaker or test article limit. This allows the user to specify a level, not to exceed the limit, against which the EDIT program compares the breakpoint levels. If the level is exceeded the editor will inform the user of the violation of the system parameter within the message line.

Type the new maximum system acceleration limit. [Range 1 g to 200 g]. Any numerical entry deletes the previous value.
Press ENTER to store the new maximum accelration level and move the cursor to the next line.

13. The cursor is at "MAX VELO (in/sec pk)" or the Maximum System Velocity Limit.

This parameter is for the entry of the maximum velocity

limit of the complete sine vibration control system. Generally this is a limitation of the power amplifier that drives the shaker without voltage clipping. This allows the user to specify a maximum level against which the Edit program compares the breakpoint levels. If the level is exceeded the editor will inform the user of the violation of the system parameter within the message line.

Type the new maximum system acceleration limit.
[Range 1 in/s to 199 in/s]. Any numerical entry deletes the previous value.
Press ENTER to store the new maximum accelration level and move the cursor to the next line.

14. The cursor is at "MAX DISPL (mils pk-pk) or the maximum System Displacement Limit.

This parameter is for the entry of the maximum displacement limit of the complete sine vibration control system. Generally this is a physical limitation of the shaker or shaker slip plate. This allows the user to specify a maximum level against which the edit program compares the breakpoint levels. If the level is exceeded, the editor will inform the user of the violation of the system parameter within the message line.

Type the new maximum system acceleration limit.
[Range 1 mil to 1999 mil pk-pk]. Any numerical entry deletes the previous value.
Press ENTER to store the new maximum acceleration level and move the cursor to the next line.

15. The cursor is now located on the first breakpoint line and if manual breakpoint entry was specified at item 8 above, the cursor would be at the last frequency or crossover frequency parameter. If the auto-breakpoint calculator mode was selected then go on to item 16.

Type the new frequency breakpoint, [Range 6 - 6500 Hz].
Any numerical entry deletes the previous value.
Press ENTER to store the new value and to advance the cursor to the next parameter.

16. The cursor is now located at control type on the first breakpoint line and if the auto-breakpoint calculator was specified at item 8 above, the cursor will be at the parameter, CONTROL type. This is also the next parameter to be entered after the crossover frequency from item 15 was supplied. The message line now prompts the selections 1 (Acceleration), 2 (Velocity) or 3 (Displacement).

Choose 1, 2 or 3 using the numeric keys. This selection causes the cursor to advance to the next parameter.

17. The cursor is now located at the "CONTROL LEVEL". As soon as a numerical entry is started the previous value is deleted.

The ranges here vary according to control type and frequency. At present, because the input level is 10 mV/g, the control level should not be allowed to go below 0.1 g pk regardless of the control type. Refer to Section 1 of this manual for the control level ranges. A Vibration Nomograph is included in Appendix A.

Type the new control level.
Press ENTER to store the new value and to advance the cursor to the next parameter.

18 The cursor is now located at "SWEEP RATE". This value is dependent on the selection made for the "SWEEP MODE" in item 5, either Log or Linear. The choice of a sweep rate is generally specified within a sine test profile spec or may be easily determined from the profile spec itself by following the formulas and examples supplied by Appendix B. The precautions noted within Subsections 5.4.1 and 5.4.2 concerning the maximum sweep speed limit for a given frequency should be followed.

Refer to Section 1 of this manual for the sweep rate ranges of the Log and Linear sweep modes.

The message line prompts with a reminder of the selected sweep mode.

Type the new sweep rate, which may be different for each breakpoint level.
Press ENTER to store the new value and to advance the cursor to the next breakpoint line. If auto-breakpoint calculator entry was selected or default, then got to item 20.
Pressing the "ESC" key exits the auto-breakpoint calculator entry mode at this point and moves the cursor to TEST NAME.

If this file is to be saved, go on to step 22.

19. The cursor is now at the following crossover frequency if manual breakpoint entry was selected, otherwise, go on to step 20. Enter the crossover or end frequency breakpoint as necessary. Refer to Appendix A if needed to aid in determining the crossover frequency.

Type the new frequency or press ENTER to accept the previous default value, if any.
Press ENTER to store the new frequency and advance the cursor to select the next parameter, CONTROL type.

20. The cursor is now located at the control type of the following breakpoint. The message line prompts the selections:

    1 (ACCELERATION)
    2 (VELOCITY)
    3 (DISPLACEMENT)

    Choose 1, 2 or 3 using the numeric keys.

    This selection causes the cursor to advance to the next parameter, CONTROL level.

21. Follow the procedures outlined in steps 17 to 19 or 20 to complete the entry of the second and succeeding breakpoint levels. Complete each breakpoint line or level before exiting from the breakpoint selection entry mode. If manual breakpoint entry was chosen, then all breakpoint lines or levels must be completed before attempting to exit or save the present database file.

    If the auto-breakpoint calculator mode was chosen then pressing the "ESC" key exits the cursor to "TEST NAME" which terminates the breakpoint entry.

22. Review the selected database for accuracy. The database file may now be saved to the sine database disk on drive B.

23. A copy of the database parameters may be printed on a dot matrix printer such as the DMP-100 by pressing either F4 (PRINT) or the "SHIFT" and "PrtSc" (print screen) keys together.

24. To exit the EDIT mode and run the newly created sine test profile, press F3 (Main Menu) to exit to the main menu screen. Then select option A, "RUN SINE TEST PROFILES".

25. To exit the EDIT mode and to select another sine test profile for review or to edit, press F2 (LIBRARY). The library menu will then be displayed.

5.6 MODIFYING AND RE-SAVING AN EXISTING DATABASE

To modify and re-save an existing sine database, perform the following procedure:

1. Place the database diskette containing the database to be modified into Drive B.

2. Enter the Edit Module by following the instructions in Subsection 5.2.

3. Once the Edit Library is entered. A list of the eleven saved database files is displayed. Select the one to be modified by positioning the blinking cursor before the appropriate file selection at the menu and press the SELECT soft key or ENTER key on the keyboard.

4. Review the file at the Edit Screen, Figure 5-2. If a different file is required, go back to the Edit Library menu by pressing F2 on the keyboard. The Edit Library menu will again be displayed; go back to step 3.

5. Move the cursor about the display and change the desired parameter values as required. Follow the applicable steps of Subsections 5.4 and 5.5.3, for saving the modified database.

5.7 MAKING BACK-UP COPIES OF PROGRAM AND DATABASE DISKETTES

Back-up copies of LINGFAX Program and Database diskettes can be made by the following procedure:

1. Follow the instructions in Subsection 5.2 to enter the Edit Module.

2. From the EDIT display screen press F3 (Main Menu) and then select option Z, "EXIT TO THE SYSTEM". The DOS prompt A>_ will be displayed.

3. Replace the LINGFAX Program diskette in drive A with he DOS diskette found inside the rear cover of the DOS Manual.

4. Type DISKCOPY A: B: (followed by) ENTER.
The DISKCOPY program will prompt that it is ready by displaying:

   "Insert source disk in drive A, and insert
   target disk in drive B, then press any key."

5. Remove the diskettes from both drives.
Place the diskette to be copied in Drive A.
Place a new diskette, onto which the program or databases are to be copied, in drive B. Note that if the new diskette is unformatted, the DISKCOPY Program will format it.

6. Follow the displayed prompts to copy one or more diskettes.

7. To return to the LINGFAX Program, replace the diskette in drive A with the LINGFAX Program Diskette.
Place the desired LINGFAX Database diskette in drive B.

Press and hold simultaneously the keys CTRL, ALT, and DELETE until the System begins to reset or type "SINE" at the DOS prompt A>_ to re-enter the sine test program.

5.8 SETTING THE SYSTEM DATE AND TIME

The date, shown at the top of the Edit Module display (Figure 5-2), are changed/updated using the LINGFAX Program diskette as follows:

1. Follow the instructions in Subsection 5.2 to enter the Edit Module.

2. From the EDIT display screen press "F3" (Main Menu) and then select option Z, "EXIT TO THE SYSTEM". The DOS prompt A>_ will then be displayed.

3. Type CLOCK/I/S (and press) ENTER. This program will initialize the clock/calendar device and set the date and time known to the System.
   The monitor then prompts: Current date is MM:DD:YY
   Enter new date:

4. If the current date is correct, press ENTER. If it is not correct, type the new date in the indicated format, where MM and DD represent the month and day digits and YY represents the last two digits of the year. Note that it is not necessary to type leading zeroes and that either the -YY or the -DD-YY may be omitted (and remain unchanged). The - may also be replaced by a /. After typing the new date, press ENTER.
   The monitor then prompts: Current time is HH:MM:SS
   Enter new time:

5. If the current time is correct, press ENTER. If it is not correct, type the new time in the indicated 24-hour format, where HH, MM, and SS represent the hour, minute, and second digits, respectively. Note that it is not necessary to type leading zeroes and that the :SS may be omitted (and remain unchanged). After typing the new time, press ENTER.
   The monitor then prompts: A>_

6. To return to the Start Menu, press and hold simultaneously the keys CTRL, ALT, and DELETE until the System begins to reset.
   To return to the Test Module, type TEST (and press) ENTER.
   Alternately, to return to the Main Menu type SINE at the DOS prompt A>_.

(THIS PAGE INTENTIONALLY BLANK)

SECTION 6

TROUBLESHOOTING AND MAINTENANCE

6.1 START-UP PROBLEMS

Experience has shown that most common system malfunctions are caused by cabling problems. Typical problems are as follows:

1. Improper system connections
2. Cable connectors loose or improperly seated
3. Cable runs physically changed
4. Cables internally damaged (not obvious externally)

Verify proper cable installation before performing any troubleshooting procedures.

6.2 VIBRATION SYSTEM PROBLEMS

The DCS-7000SR is a closed loop controller. When troubleshooting to find the cause of a problem, be aware that a malfunction of a vibration system component other than the DCS-7000SR may reflect as an apparent problem in DCS-7000SR operation. Other possible sources of trouble can be the shaker, amplifier, accelerometers, cables, or other related system electronics equipment. Ground loops may also exist between system components that could hamper operation, particularly at low acceleration levels.

6.3 DCS-7000SR OPERATING PROBLEMS

Most common operating problems will produce an error message on the monitor. Table 6-1 presents a listing of these error messages, the System action taken, and possible causes/corrective actions.

6.4 OTHER TROUBLES

In the event of troubles not covered in this Instruction Manual, contact Ling Customer Service. Be prepared to give the Model and Serial numbers of the unit, the software Version number, the conditions of use, and a full description of the problem.

Should it be determined that the DCS-7000SR is at fault, the unit should be carefully packed and returned to the factory for repair. All pertinent information about the fault should be enclosed with or attached to the returned unit.

Table 6-1. DCS-7000 System Error Messages

MESSAGE	SYSTEM ACTION	POSSIBLE CAUSES/ CORRECTIVE ACTIONS
System Abort	ABORT	Test item resonance detected. Use multiple accelerometers to control resonance. Noise in system cables or faulty accelerometer. Damaged shaker, fixture, or test item.
Database Error Detected	DATABASE REFUSED	Faulty diskette or drive. Affected database has an error or has been damaged in some way. Replace damaged file with a newly created file by using the edit library menu.
Loop Open	ABORT	Determine if accelerometer or or its cable is at fault. Check amplifier drive signal cable and gain setting.
Waiting for Controller	ALARM	System bus is busy or the Sine Controller board is not ready to service the host system request.
No Communication	ABORT	Host System timeout. Sine Controller board did not service host system request. Try rerunning sine test profile after "No Communication" message clears. Possible sine profile or database could have invalid parameters.
Hardware Fault	ABORT	Possible sine or system board failure. Calibration check indicates a wide difference between previous default calibration setup and check values. Sine profile data base fault.

Table 6-1. DCS-7000 System Error Messages (Continued)

MESSAGE	SYSTEM ACTION	POSSIBLE CAUSES/ CORRECTIVE ACTIONS
Missing Sine Controller Board	HALT	The Sine Controller board is not responding or does not exist in the system. Sine Controller board is not firmly connecting with the system bus connector.
Fault 1,2 or 3	ABORT	Internal computation error. Retry sine profile.
Fault 1019	RESET	File not found. Faulty disk drive, clean disk heads. Drive door not closed

6.5 MAINTENANCE

Computer Checkup, a computer diagnostic program has been supplied on a diskette with the DCS-7000SR System. This program is used to test the monitor, dual diskette drives, keyboard, random access memory, and optional dot matrix printer. Instructions for its use are given on a card entitled "Read Me First", packaged with the diskette, and in a series of on-line displays available during operation of the program.

With the diskette in Drive A, the program is started either automatically or by typing POWERUP or CHECKUP (followed by ENTER) at the DOS prompt. (Refer to the card.)

For maintenance purposes, this diagnostic program should be run on a frequent, regularly scheduled basis. Once every two weeks is recommended during periods of heavy usage of the System. The program should also be run after the System has been moved, after a long period of disuse, and whenever any System functional problem is noted.

The only other maintenance necessary for the DCS-7000SR is to keep the chassis free from dust and moisture. To clean the chassis, use low pressure air, a vacuum cleaner, or a soft bristle brush. Use particular care when cleaning the printed circuit boards, as they are easily damaged.

(THIS PAGE INTENTIONALLY BLANK)

SECTION 7

GLOSSARY OF TERMS

7.1 PURPOSE

The purpose of this Glossary is to provide definitions of some of the terms used in the DCS-7000SR monitor displays and this manual. Some definitions have been reduced in scope and simplified to reduce mathematical content and conform to usage of the terms in the present context.

For ease of reference, the terms have been grouped into three separate catagories: General System and Sinusoidal Vibration Terminology, Database Parameters and Commands, and Soft Switch Labels. Terms used in a definition and defined elsewhere in this Glossary are underlined.

7.2 GENERAL SYSTEM AND RANDOM VIBRATION TERMINOLOGY

Abort: Refers to the process of rapidly terminating the drive signal to the shaker system. An abort may be initiated manually by switch action or automatically by detection of an out-of-limit condition.

Accuracy: The degree of conformity of a measurement to a specified standard or true value. Usually expressed as the ratio of the measured value to the specified value (in dB), or the difference between the measured value and the specified value (in percent).

Alarm: Refers to the limit condition above or below which the System issues a warning message to the operator of a possible impending condition requiring an abort.

Breakpoint Frequency: Refers to one of the set of two or more frequencies used to define the reference profile in a test database.

Database: A listing of the parameter values and other descriptive information used to completely specify a test. In the DCS-7000SR, databases are stored in files on diskettes, ready for reloading into memory as required.

Decibel (dB): A measurement unit which denotes the size of the ratio of two magnitude-squared quantities or two quantities which are proportional to or analogous to power. The ratio expressed in dB is 10 times the logarithm to the base 10 of the ratio of the quantities.

For example:

$$dB = 10 \log \left[\frac{V^2}{(V_{ref})^2} \right] = 10 \log \left[\frac{V}{V_{ref}} \right]^2 = 20 \log \left[\frac{V}{V_{ref}} \right]$$

Default Database: Refers to a database contained on each diskette which is available for loading into memory immediately upon startup of the System. Often, this database is that of the most frequently used test.

Full Test Level: Refers to the overall g peak acceleration of the reference profile, to which the System controls the actual sinusoidal vibration.

G PEAK: Refers to the overall g peak acceleration determined by the analysis at the end of the current loop; displayed in a Single Channel System.

Linear System: A system is linear if, for every element in the system, the response is proportional to the input. The dynamic properties of each element can be represented by a set of linear differential equations, and, for the system as a whole, the principle of superposition holds.

Loop: Refers to the repetitive sequence of operations required to effect control (e.g., equalization).

Mode: Refers to one of the four phases of operation in the Test Module sub-program of the LINGFAX main program. The five modes are Standby, Full Test, Completed, and Aborted. Each mode provides a certain set of soft switch functions for selection by the operator.

Module: Refers to a major sub-program within the LINGFAX main program. The major LINGFAX modules are Help Function, Library, Edit, and Test.

Octave (Oct): Refers to the interval between two frequencies having a ratio of two. The number of octaves, n, between two frequencies f_1 and f_2 is given by:

$$n = \frac{\log \left[\frac{f_2}{f_1} \right]}{\log [2]}$$

Sinusoidal (Vibration): One cycle of a steady-state sinewave has associated with it a length of time called its

period after which the amplitude of motion versus time exactly repeats itself in accordance with the sinusoidal waveform pattern. The number of cycles per second (reciprocal of the period) is called its frequency (units are cycles/s or Hz).

Reference Profile: Refers to the required test or control acceleration profile specified in the database for a given test. The profile shape is determined by the Acceleration, Velocity and Displacement values at specified breakpoint frequencies within the total frequency range.

Compression Speed: A measure of the ability of the system to slew the output in response to a step change. Expressed in dB/sec. This is typically a function of frequency and step size.

Control Accuracy: The ability of the closed-loop control system to retain a control level within a stated error value either for a static test condition (nonsweeping) or in the presence of dynamic changes in the control loop.

Octave: The frequency difference when two sinusoidal waves have a frequency ratio of 2. The interval, in octaves, between any two frequencies is the logarithm to the base 2 of the frequency ratio, or expressed in terms of Log to base 10,

$$n = \frac{\text{Log}_{10}\ (f_2/f_1)}{\text{Log}_{10}\ 2}$$

where:

n is in octaves
f_2 is the upper frequency
f_1 is the lower frequency

Control Crossover frequency: The frequency at which control is changed from one parameter to another such as displacement to acceleration. These changes may be steps or smooth transitions as defined in the reference profile.

Output Dynamic Range: The dynamic range capbility of the system as measured at the output of the controller. Measured as a ratio of the largest signal that can be produced (with a distortion below a specified level) to the smallest signal produced that is equal to or greater then the output (rms) noise in a stated bandwidth. Expressed in dB.

System Gain: A measure of the forward gain of a system expressed as the ratio of the magnitude of the controlled parameter to the magnitude of some standardized input sig-

nal (rms g/volt, peak g/volt, etc.). The gain of the system may vary with frequency.

Q (Quality Factor), Mechanical System: A measure of the sharpness of resonance vibratory system having a single degree of freedom. The Q of a mechanical system is equal to one-half the reciprocal of the damping ratio.

Linear Sweep Rate: This specifies the rate of change of frequency which is expressed in Hz/minute for linear sweeps.

$$\text{Rate} = \frac{f_{high} - f_{low}}{\text{Time}} \text{ in Hz/s}$$

where:

f_{high} = highest frequency limit
f_{low} = lowest frequency limiit

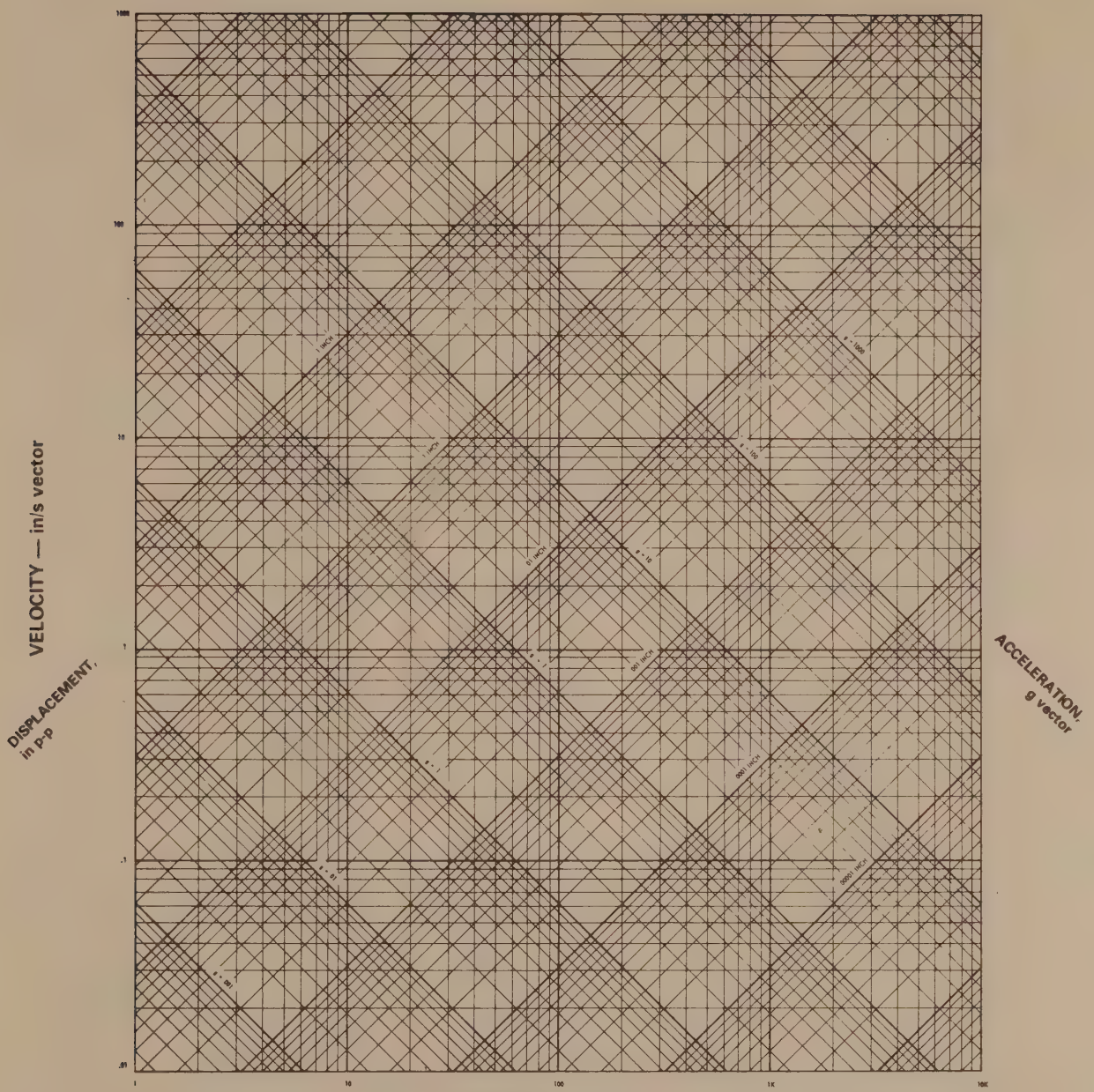
This specifies the rate of change of frequency which is expressed in octaves/minute for logarithmic sweeps.

$$\text{Rate} = \frac{\text{Log } (f_{high}/f_{low})}{\text{Time x Log}_{10}2} \text{ in octaves/min, for log sweeps}$$

where:

f_{high} = highest frequency limit
f_{low} = lower frequency limit

APPENDIX A



Example: Given Frequency = 100 Hz
and Displacement = .02 in p-p
then, Acceleration = 10 g vector
and, Velocity = 6.2 in/s vector

VIBRATION NOMOGRAPH

(THIS PAGE INTENTIONALLY BLANK)

APPENDIX B

USEFUL CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
Acceleration:		
g	9.8067	meters/second^2
	386.088	inches/second^2
cm/second^2	0.010	meters/second^2
inches/second^2	0.0254	meters/second^2
Force:		
dynes	1 x 10-5	newtons
kilograms (force)	9.807	newtons
newton	0.102	kilogram (force)
newton	0.225	pound (force)
pound	0.4536	kilogram (force)
pound	4.448	newtons
Length:		
inches	1000.0	mil
inches	2.54	centimeters
inches	25.40	millimeters
inches	0.0254	meters
meters	39.37	inches
millimeters	0.0394	inches
millimeters	39.37	mil
Mass:		
kilograms	2.205	pounds
pound	0.454	kilograms
Velocity:		
inches/second	0.0254	meters/second
meters/second	39.370	inches/second

CALCULATIONS FOR PURE SINUSOIDS

rms value	=	0.707 x peak value
rms value	=	1.11 x average value
peak value	=	1.414 x rms value
peak value	=	1.57 x average value
average value	=	0.637 x peak value
average value	=	0.90 x rms value
peak-to-peak	=	2 x peak value
crest factor	=	$\frac{\text{peak value}}{\text{rms value}}$ (applies to any varying quantity)

FORMULAS FOR SINUSOIDAL MOTION

Octaves:

$$N_{octaves} = 3.322 \log_{10}\left[\frac{f_{high}}{f_{low}}\right] = \frac{\log_{10}\left[\frac{f_{high}}{f_{low}}\right]}{\log_{10} 2}$$

Decibel (dB):

$$dB_{(power)} = 10 \log_{10}\left[\frac{p_1}{p_2}\right]$$

$$dB_{(volts)} = 20 \log_{10}\left[\frac{v_1}{v_2}\right]$$

$$dB_{(amps)} = 20 \log_{10}\left[\frac{I_1}{I_2}\right]$$

Linear Sweep Rate:

$$N_{rate}\ (Hz/sec) = \frac{BW_{(bandwidth)}}{T_{time}\ (sec)} = \frac{f_{high} - f_{low}\ (Hz)}{T_{time}\ (sec)}$$

Log Sweep Rate:

$$N_{rate}\ (oct/min) = \frac{M_{octaves}}{T_{time}\ (min)} = \frac{\log_{10}\left[\frac{f_{high}}{f_{low}}\right]\ (oct)}{\log_{10} 2 \times T_{time}\ (min)}$$

EXAMPLE CALCULATIONS

Computation of Linear Sweep Rate

Given:

T	= duration of sine sweep test in minutes
S	= total number of sweeps
f_{low}	= first breakpoint frequency
f_{high}	= last breakpoint frequency

$T = 60$ minutes, $S = 10$ sweeps, $f_{low} = 10$ Hz, $f_{high} = 110$ Hz

then

$$t\ (\text{sec/sweep}) = \frac{\left[T_{(\text{minutes})} \times \frac{60\ (\text{sec})}{1\ (\text{min})}\right]}{S_{(\text{total sweeps})}}$$

$$= \frac{[60 \times 60]}{10} = 360 \text{ sec/sweep}$$

Linear Sweep Rate

$$N_{rate}\ (\text{Hz/sec}) = \frac{f_{high} - f_{low}}{t(\text{sec/sweep})} = \frac{110 - 10}{360} = 0.28 \text{ Hz/sec}$$

Computation of Logarithmic Sweep Rate

Given:

T	= duration of sine sweep test in minutes
S	= total number of sweeps
f_{low}	= first breakpoint frequency
f_{high}	= last breakpoint frequency

$T = 60$ minutes, $S = 10$ sweeps, $f_{low} = 10$ Hz, $f_{high} = 80$ Hz

then

$$t\ (\text{min/sweep}) = \left[\frac{T_{(\text{total minutes})}}{S_{(\text{total sweeps})}}\right] = \frac{30 \text{ minutes}}{10 \text{ sweeps}} = 3 \text{ min/sweep}$$

Log Sweep Rate

$$N_{rate}\ (\text{octaves/min}) = \frac{3.322\ \text{Log}_{10}\ [f_{high}/f_{low}]}{t\ (\text{minutes/sweep})}$$

$$= \frac{3.322\ \text{Log}_{10}\ [80\ \text{Hz}/10\ \text{Hz}]}{3}$$

$$= 1.0\ \text{octave/minute}$$

(THIS PAGE INTENTIONALLY BLANK)

www.manualsplus.com
1025632